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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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Lacquering — *an art that was never lost*

Our Exhibit at the Ninth Exposition of Chemical Industries

THAT "Lacquering—an art that was never lost" is decidedly true has never been more clearly demonstrated than it was by our exhibit at the Ninth Exposition of Chemical Industries held in Grand Central Palace, New York, during the week of September 17, 1923. On display were innumerable articles picked at random from the stocks of our customers, ranging from toys to costly pieces made from silver and gold, all of which were treated with Egyptian Lacquers or Lacquer Enamels either to produce or preserve a finish.

There were also exhibited large pieces such as scales, washing machines and heavy cast articles which had been finished with Egyptian Enamels applied over a foundation of Egyptian Metal Primers, Fillers and Glazes.

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The Production of Antimony and Lead

A Visit to the Well-known Works of Cookson & Company, Newcastle-on-Tyne, England

It is a generally known fact that almost all the main industries of England are closely associated with particular areas or towns. One cannot think of steel production without thinking of Sheffield, or of cotton without Manchester. So, too, do we speak of Newcastle-upon-Tyne as the home of the lead industry, and, through Cookson, Tyneside qualifies as the most important district in Europe for the production of antimony. Indeed, one may narrow the thought to the personal, and say that, just as the name of Bessemer at once implies steel, so also does that of Cookson lead and antimony.

No apology need therefore be given for an account of a visit to the works of Cookson & Company. Founded in 1704, they are at once the oldest and largest firm in the lead industry in England, and the extent and capacity of their antimony works can best be understood when it is stated that at one period during the war these works, together with one or two smaller works, were able to supply not only Britain's own enormous demand for antimony for shrapnel bullets, but also exported considerable quantities to the allies.

Their products naturally divide into two main branches, viz., antimony and lead, and for these they have separate works, at Willington Quay (antimony smelting and lead smelting, and de-silverizing), and at Northumberland Dock (white lead, red lead, and litharge).

One felt throughout the visit that the first-rate reputation they possess for reliability in their products was due partly to their long experience, but more especially to alertness and skill in scientific control. The works have been long established, but the plant is thoroughly up-to-date and in the control of separate technical specialists.

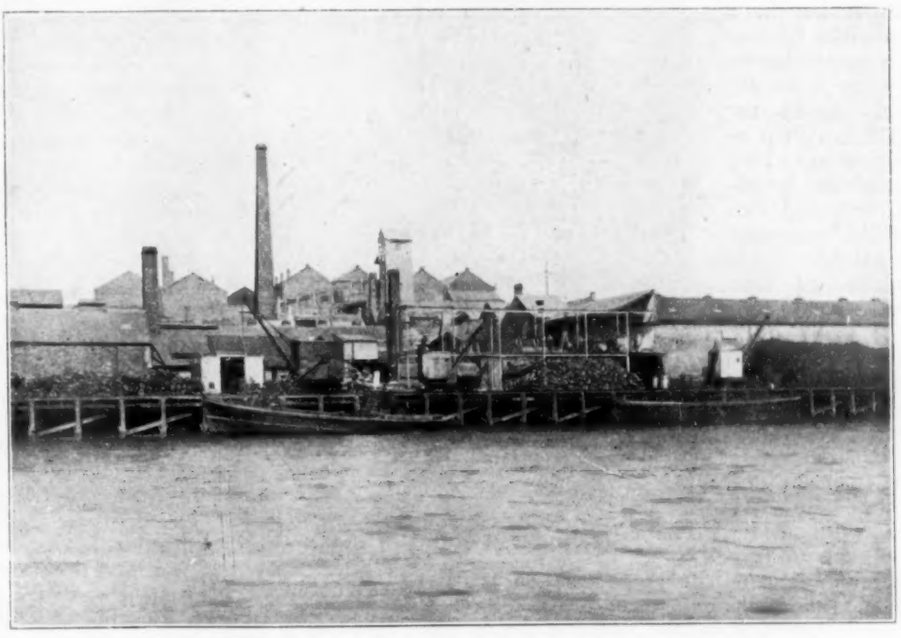


FIG. 1.—VIEW OF COOKSON'S (TYNESIDE) WORKS.

ANTIMONY

The antimony ores treated at Willington Quay are from China, Mexico, or Bolivia. The different parcels are generally graded abroad, and only high grade selected ores are taken for treatment. The well-known stibnite (sulphide of antimony) is the ore usually handled, but smaller parcels of oxide ore are also received. This latter ore is really the surface ore from the stibnite mines, which has been weathered and oxidized. The two types require fundamentally different treatments; for the sulphide ore the general method used is the English, or precipitation process, and for the oxide ore the carbon reduction process. These treatments, again, vary with different parcels of the same class of ore, depending on the constituents present.

Before giving an outline of the actual processes in operation for, say, a rich sulphide ore, it should be said that the steel-grey, needle-shaped form of the true sulphide ore is easily distinguishable from the oxide, which, though still bearing more or less the needle-shaped formation, more nearly approaches sandstone in texture. The oxide may be either the Sb_2O_3 or SB_2O_4 or both, but it is always reduced by carbon to give carbon monoxide and antimony, thus:—

$$Sb_2O_3+3C=3CO+2Sb$$

In the precipitation process iron is used to decompose the

sulphide of antimony to give sulphide of iron and antimony as in the equation:—

$$Sb_2S_3+Fe_3=2Sb+3FeS.$$

From these reactions it may be observed that the chemistry of the process is really very simple. On the other hand, however, the actual manufacture undoubtedly calls for wide experience.

It was not anticipated that actual working figures of charges and temperatures could be divulged, though the works manager showed clearly the main outlines and reactions of one of the methods followed. This working of a particular charge was of great interest. It showed that the metallurgy of antimony was indicative of many processes used by metallurgists, and in many ways was typical because of the variability of parcels calling for modification of treatment.

One other fact is worthy of notice. Readers of text-books on the metallurgy of antimony, especially that of Wang, will have found that the roast-reduction process is stressed, and the question may be asked why such a process is not generally followed in this country. Two reasons may be given. The iron is easily obtainable here, and if the sulphur were removed by roasting and reduction, it must pass off as sulphur dioxide; unless a special plant were devised for its collection and treatment it would be a considerable nuisance to the neighborhood. This difficulty is completely overcome by the English process, for the sulphur is fixed by the formation of sulphide of iron.

THE PRECIPITATION (ENGLISH) PROCESS.

This is carried through in three distinct operations, known as singling, doubling, and starring.

(1) **Singling.**—After the composition of the ore is ascertained in the laboratory, the charge is calculated so that the requisite amount of iron may be added. It is then heated to fusion in a crucible furnace in approximately one hour. By this means the decomposition of the sulphide is effected, and metallic antimony obtained. Sulphide of iron rises through the metal as a slag, and after the metal is cast the slag is easily separated. The antimony is now in an impure state, and assays about 95 per cent.; in this condition it is of little value until the main impurity, iron, is removed.

FIG. 2.—ONE OF THE ANTIMONY REFINING PROCESSES.

(2) **Doubling.**—The preparation of the "doubles" may be carried out in either a crucible or a reverberatory furnace, depending on the quality and constituents of the crude metal being treated. The essential features of this process are liquation and the removal of the iron by suitable fluxes.

The effectiveness of the liquation can be understood when it is remembered that in such an alloy of antimony and iron intermetallic compounds are present. One of these, with the chemical formula Fe_3Sb_2, has a freezing point of 1,016° C., and another, $FeSb_2$, which forms from Fe_3Sb_2 and liquid, crystallizes out at 730° C. The melting point of pure antimony is 629° C. Hence, in the heating up of this alloy, the antimony first melts and the antimony-iron compounds tend to separate and rise to the surface. These are "taken up" by the slag and removed from the bath or metal under purification.

After this operation, the antimony assays about 99 per cent., and it is then ready for "starring."

(3) **Starring.**—The "Starring" is carried out in crucible furnaces. "Doubtless" are melted with special low-melting alkaline flux or slag, and this still further refines the antimony to 99.6 per cent. and over. When ready for casting the metal is poured into the usual flat chill molds, giving ingots weighing 30-40 lbs. each. The flux serves a double purpose, for it not only refines the metal while it is in the furnace, but, having a low melting point, it permits the metal to solidify first. In doing this the standard Star formation of pure antimony of commerce is obtained.

In watching these operations one was reminded of the great volatility of antimony, but Messrs. Cookson have a thoroughly efficient system of fume catching, of the baghouse type, in conjunction with "Sirocco" fans. The plant is necessarily extensive, and includes roasting furnaces, crucible furnaces, reverberatory furnaces, and large blast furnaces. With all in operation, treating a volatile metal, it can be imagined what the result would be if a carefully organized system of fume removal were not in use.

TIMONOX.

For a considerable time Cooksons felt that a really **white** pigment was needed by the paint trade, and as a result extensive experiments were undertaken with a view to supplying this need. Oxide of antimony had been tried before and had failed, because of bad color and size of particle. But this did not deter them, for, working on the volatility and rapid oxidation of antimony, they were ultimately able to prepare an antimony oxide suited to the high standards required for paint and enamel manufacture.

Another development, has been made in the application of timonox to the manufacture of white enamel glaze, for use on sheet metal and cast-iron goods (as an opacifier). Tin oxide is generally used for this purpose, but the whiteness of the sample plates shown was sufficient evidence of the value and future of timonox in this direction.

GOLDEN SULPHIDE AND CRIMSON SULPHIDE.

In completing the visit to the antimony works, an inspection of the sulphide departments was made. In these the staffs were engaged in the production of purely chemical substances. The golden sulphide is prepared by the precipitation, by acid, of an alkaline sulphantimoniate, the actual strengths and temperatures of which have been carefully worked out to give the particular grades of sulphide asked for by the rubber manufacturers. Both the red and golden varieties are used in the manufacture of red rubber, and the processes are such that highly-skilled supervision is essential.

Each department is equipped with the latest types of filter presses, drying ovens, pumps, etc.

LEAD.

The visit to the lead works was of as great interest as that made to the antimony works. The metal itself, from the fact of its low-melting temperature and softness, fascinated most of us, as boys, when we poured it into roughly-made molds, but, whereas our interest was sus-

tained in playing with a few ounces of lead, the Cookson works have furnaces each carrying up to 250 tons, and the way in which this is handled in its passage from one operation to another would stir the interest of the oldest of us. Their plant might serve as a model to any works,

FIGS. 3 AND 4.—THESE BLOCKS SHOW THE STAR BORNE BY THE SURFACE OF COOKSON'S "C" BRAND ANTIMONY, WHICH IS GUARANTEED 99·6 PER CENT. PURE.

and, indeed, has been so used by several large Continental firms. The outstanding feature to the visitor is the very complete system of lifting the metal by means of hydraulic cranes, which seem to stand at every conceivable corner.

Most of the lead comes to the works in an impure, pig form, from the smelters. It contains as noble metals, gold and silver, and as impurities, copper, arsenic, antimony, tin, and sulphur. The first operation is to reduce, as far as possible, the impurities without affecting the gold or silver. It is then taken to zincages for the removal of these latter metals, and afterwards refined to remove the zinc remaining from the previous operations. This gives the market lead, which is despatched as the usual and familiar pig lead. From this it will be seen that the Parke's process is that adopted, but a short description of the progressive stages through which the lead actually passes may be of interest.

(1) **Softening or Improving.**—As already stated, the impurities mentioned above must be thoroughly eliminated; the lead is therefore charged into the improving furnace and raised to a red heat. The furnaces actually seen carried a burden of almost 200 tons, and as the temperatures rose the oxides quickly accumulated on the surface of the bath, and by careful removal of these the metal was freed of all impurities, except part of the copper. It was then cast into molds giving about 1-ton slabs which, when solid, were hoisted by cranes to the zincages.

(2) **Zincages.**—In these the lead is melted and raised to a temperature higher than the melting point of zinc (419° C.), and at this point zinc is added and well rabbled into the bath. On cooling, the insoluble zinc is the first to crystallize as a surface crust, and is removed by perforated ladles to another pot or "kettle." The main lead bath is treated again, maybe two or three times, with zinc and the operations repeated until the silver and gold are all extracted.

The zinc crust which crystallizes out has a stronger affinity for the noble metals than lead), and at the same time carries with it the remainder of the copper. We have now roughly forty tons of lead in the main kettle (usual capacity of which is 40 tons) containing no silver, gold or copper, but containing about 1 per cent. zinc. This lead is now run directly into the refining furnace by syphons for refining.

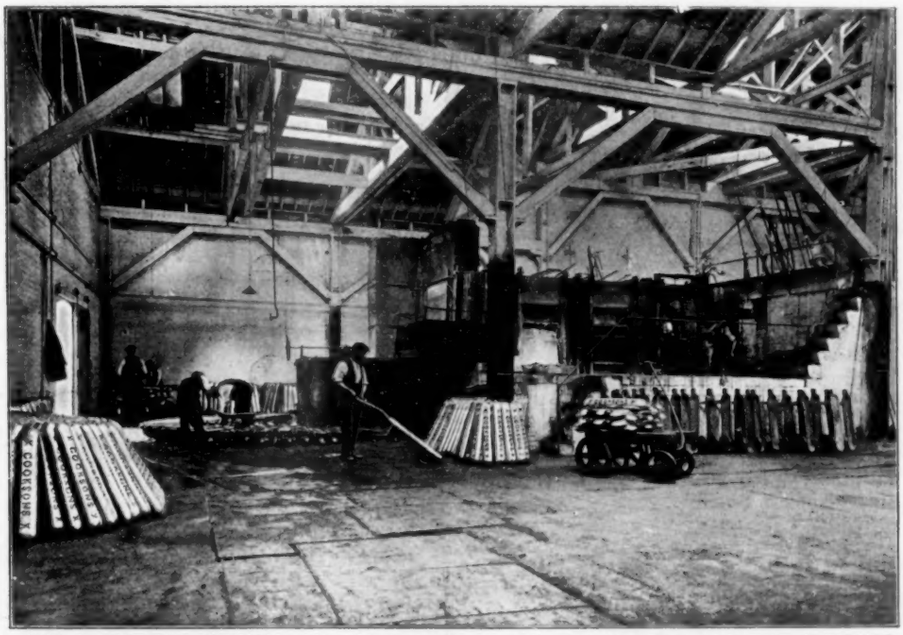


FIG. 5.—IN THIS PROCESS ZINC IS ADDED TO THE SILVER LEAD AND THE MIXTURE SUBJECTED TO RED HEAT AND KEPT IN VIOLENT MOTION. ON COOLING THE ZINC CONTAINING PRACTICALLY ALL THE GOLD AND SILVER RISES TO THE TOP. THIS CRUST IS SKIMMED, AND BY MEANS OF A FURTHER PROCESS THE GOLD AND SILVER ARE RECOVERED.

(3) **Refining.**—The furnace used for this operation is of the reverberatory type, and in it the lead is heated to approximately 1,000° C. for several hours. The zinc is volatilized, or slagged off with the litharge which forms, and the resulting metal is the pure lead of commerce ready for the market. On analysis it has been found to be as high as 99.994 per cent. pure.

British Institute of Metals

Abstracts of Papers Read at the Autumn Meeting in Manchester, England, September 10-12, 1923

THE USE OF NON-FERROUS METALS IN ENGINEERING

SECOND AUTUMN LECTURE DELIVERED BY LIEUT.-COLONEL SIR HENRY FOWLER

Of all these metals the one which has been in longest use is copper, and it is at present the one most closely associated either by itself or alloyed with engineering work. The uses to which its comparatively simple alloys with tin and zinc can be put are endless. The next in importance is perhaps tin which, alloyed with copper, lead and antimony, give us those white metals which allow bearings to be a practical proposition.

Aluminum is one of the most interesting of the series of metals, and although from an engineering standpoint it is perhaps most generally used in connection with aeronautics, recent investigations have opened up a new field for its use.

There still remain numbers of other metals which as alloys are helping to solve the problems which the advances in recent engineering practice bring in their train.

THE CAUSE OF RED STAINS ON SHEET BRASS

BY E. A. BOLTON.

The author gives an account of work carried out to elucidate this problem. The various theories which have been from time to time put forward are reviewed and experiments described which bear upon these theories. Although the experiments were carried out in the laboratory, close touch was established throughout with actual works' practice. The outstanding point is that the stains actually occur through reactions of copper oxides in the scale formed during annealing and the picking medium. Cupric oxide, contrary to the usual opinion, is shown to be as harmful as cuprous oxide.

It is shown that oxides of copper may be present from various causes, such as careless washing after the pickling operation resulting in the presence of acid and salts during the subsequent annealing, the presence of iron in the brass or upon its surface, the use of impure rolling oils, etc. It is concluded, however, that the main cause of the oxidation of the copper is the use of old-fashioned annealing furnaces in which the flames impinge directly upon the brass.

The paper concludes with a brief account of possible remedies for the red-stain trouble.

BRINELL HARDNESS NUMBERS

BY H. W. BROWNSDON.

Dr. Brownsdon presented a Note on Brinell Hardness numbers with a view to drawing attention to the desirability of authors expressing Brinell numbers for non-ferrous metals in figures that may be comparable. This is not a difficult matter seeing that the desired result is obtained if balls and loads are used for which the ratio $\frac{L}{D^2}$ (the load in kilogrammes divided by the square of the ball diameter in millimetres) is constant. The only solution of the difficulty lies in agreeing upon some one ratio for $\frac{L}{D^2}$ to be invariably used for one class of alloys, and Dr. Brownsdon suggests that the choice for the large group of copper alloys with Brinell hardness numbers from about 40 to 200 should rest between the ratio 5 as standardized in the United States or the ratio 10 which is favored in some quarters in England.

STEREOTYPING

BY A. H. MUNDEY AND JOHN CARTLAND.

This is a short but very practical paper of real but unusual interest to metallurgists. It describes the process of stereotyping which is generally regarded by printers as one which is almost a trade secret. The authors point out that the process was invented by a practical metallurgist, William Ged, an Edinburgh goldsmith in 1750.

The evolution of stereotyping is traced from the plaster-of-Paris process to the use of papier-maché flong, and from the simple stereo plates for flat-bed machines to the elaborate requirements of the modern newspaper. Illustrations and descriptions of the Autoplate and Junior Autoplate machines are given, and also the recently introduced Winkler machine.

The metallurgical trials and difficulties are briefly dealt with, and the consideration of metallurgists is invited to some of the problems involved. The authors point out with truth that the industry is much more important than is usually understood, and they call attention to the high degree of accuracy demanded in the mechanical and metallurgical details in order to produce the results which are a commonplace to everyone.

CRYSTALLIZATION EFFECT ON GALVANIZED IRON SHEETS

BY J. D. HANNAH AND E. L. RHEAD.

Manufacturers of galvanized iron and steel goods, specially corrugated sheets in which it is desired to obtain the best appearance, have always sought to produce a zinc covered surface having large characteristic spangles. Failure to do this is a frequently recurring source of trouble and loss. The absence of, or the production of, only small spangles has been attributed to many causes. The quality of the steel, either the presence of sulphides and other non-metallic inclusions, or its condition produced by rolling and subsequent treatment, the pickling, either caused by impurities in the acid, by the occlusion of gas by the metal, the temperature of the bath, and the purity of the zinc, have all been blamed for the failures.

The paper gives an account of a research to ascertain the real causes. Little assistance can be obtained from literature on the subject.

The research shows that the metal—iron or steel—has practically no influence on the result if the temperatures are satisfactorily maintained. After the conditions of good work had been established, samples of both good and bad sheet from which the zinc had been stripped, gave equally good results. It was shown that pure zinc did not yield the desired large spangles and that too high a temperature interfered by producing large quantities of a zinc iron compound

which crystallized in needles on the metal and interfered with the development of the spangle. The presence of tin or aluminum—contrary to expectation and as commonly stated—did not produce the desired result, but the addition of lead did so immediately.

Judging from the known relationships between zinc and lead the authors argued that the separation of the impure zinc forming the layer on the metal sheet into conjugate solutions—lead rich and zinc rich—at the dipping temperature, and the method of subsequent crystallization, were the causes of the effects obtained. That this occurred was proved by the analysis of different types of spangle occurring on the same sheet, and by the observed differences in the rate of attack of different spangles forming the coating. The separation is attributed to the difference in the surface tensions of the two solutions. That such differences exist was proved by experiment.

Proof of the hypothesis is furnished by the fact that bismuth, the only common metal that resembles lead, more or less, in its relations with zinc, produces similar effects. The temperature at which good results can be obtained is limited by the tendency to form excessive amounts of the iron zinc compound previously referred to, and the time occupied in dipping and cooling.

EFFECTS OF RATE OF COOLING ON THE DENSITY AND COMPOSITION OF METALS AND ALLOYS

By R. C. Reader.

The note is concerned chiefly with two rates of cooling, fast and slow, as produced by casting in chill and sand moulds. The results recorded show that the densities of pure metals are not affected by the rate at which they solidify, and a similar remark applies to those alloys which solidify at a constant temperature. In the case, however, of those alloys which solidify over a range of temperature the rate at which they pass through this range seriously affects the density, the slower the rate of solidification the lower being the density. Also when alloys which possess a long solidifying range are prepared in cylindrical chill moulds they are less dense in the centre than at the outside. Rapid solidification has a pronounced effect on the composition throughout the mass of those alloys which solidify over a range of temperature. When prepared in chill those alloys are found to be richer on the outside in the component of the lower melting point and richer in the centre in the component of the higher melting point. Sand castings in these alloys are uniform throughout. Alloys which solidify at a constant temperature are uniform in composition throughout whether prepared in sand or chill moulds.

THE EFFECTS OF SMALL QUANTITIES OF NICKEL UPON HIGH-GRADE BEARING METAL

By A. H. Mundey and C. C. Bissett.

This note gives a brief account of a practical trial of the effect of varying small quantities of nickel upon a tough and well reputed bearing metal.

There was chosen for test the well known alloy consisting of tin, 93 per cent; antimony, 3.5 per cent; copper, 3.5 per cent.

The authors state that nickel is now found to be added to some considerable extent, possibly as a means of identification, but some merit is also claimed for it.

The results of the usual physical tests are detailed. Tensile, compression and hardness tests gave no indication of improvement due to the nickel; in fact, the alloys were rather inferior when containing nickel. Running trials on the Thurston machine on strictly comparative lines showed practically no change as between nickel and non-nickel alloys.

The comparison of hardness at varying increased temperatures exhibited no improvement. Probably the most interesting feature is the structure as shown under the microscope. In the case of the alloy with no nickel the hard copper-tin constituent is very marked in its characteristic crystalline formation. The presence of nickel even in small quantities results in a great diminution of this crystalline structure, and the structure is only in a measure restored by the addition of more copper.

The authors conclude from their experiments that the beneficial results of nickel in alloys of the character employed are yet to be demonstrated.

THE MEASUREMENT OF THE CHANGE OF VOLUME IN METALS DURING SOLIDIFICATION

By Hikozo Endo.

In the casting process it is very important to know to what extent a change of volume occurs during solidification. Notwithstanding this great necessity, the literature concerning the phenomena is very scanty, because of the lack of a suitable method for arriving at an accurate determination. In 1888, Vincentini and Omodei calculated the charge of volume of some fusible metals during solidification from the change of density at the melting point. The measurement of the density of different metals in the vicinity of their melting points has been the subject of inquiry by several investigators among which are to be mentioned E. Wiedemann, Paul Pascal and Louis Hackspill. M. Toepler, who studied the change of volume by means of a dilatometer, suggested a relation of the change of volume of a metal at melting point to its atomic weight, similar to that of the atomic volume to the atomic weight. Recently K. Bornemann and F. Sauerwald also measured the density of metals at various high temperatures by means of the Archimedes principle, using a mixture of sodium and potassium chlorides as liquid.

The present investigation was started in April, 1921, and the measurement of the change of volume during solidification or melting for a number of metals having low melting points up to 1,100° C. has now been finished. This paper contains the results of the measurements, and forms the first report of the results of the investigation of a long series of experiments, which are to be extended to other metals having higher melting points.

The method of investigation, which was suggested by Professor K. Honda, consists in the measurement of the change of buoyancy of a metal suspended in an inactive liquid during its solidification or melting by means of a thermobalance.

THE CONSTITUTION AND AGE-HARDENING OF THE QUARTERNARY ALLOYS OF ALUMINUM, COPPER, MAGNESIUM AND MAGNESIUM SILICIDE

By Marie L. V. Gayler.

The paper deals with the constitution and age-hardening of the quaternary alloys of aluminium, copper, magnesium, magnesium silicide, containing up to 6 per cent copper, 4 per cent magnesium, and 4 per cent magnesium silicide.

In a quaternary system it is only possible to repre-

sent the equilibrium of the system at any single temperature, and the isothermal sections take the form of regular tetrahodra. For the above investigation isotherms at 400°C. and 250°C. have been determined from the results of thermal and microscopic examination, and wire models have been constructed.

The results show that when copper, magnesium, magnesium silicide are present in aluminium, any two of these components have a marked effect on the solubility of the third. The sum of these effects is that ultimately $CuAl_2$ and Mg_2Si are both thrown out of solution. Also, if copper and magnesium are present in a ratio greater than 12 to 5 approximately, then alloys when quenched from high temperatures age-harden at room temperature, owing to the difference in the solubility of Mg_2Si at the quenching and ageing temperature. If, however, the ratio of copper to magnesium is less than 12 to 5, then no age-hardening takes place, since there is little difference in the solubility of Mg_2Si at high and low temperatures. The slight increase in hardness obtained on further heat-treating these quenched and aged alloys is attributed to the small difference in solubility of copper at the quenching and ageing temperature. It is shown, therefore, that the age-hardening of alloys of the "Duralumin" type is due primarily to Mg_2Si, copper causing very little age-hardening, and that the addition of magnesium and copper is important since both reduce the solubility of Mg_2Si at high and low temperatures and consequently reduce the maximum age-hardness due to Mg_2Si.

THE ELECTRO-CHEMICAL CHARACTER OF CORROSION

By Ulick R. Evans.

Experiments are described which indicate that the corrosion of metals is mainly—probably entirely—electrochemical in character. There are two main types. The type accompanied by evolution of hydrogen gas is characteristic of reactive metals placed in acid solutions, but the velocity varies greatly with the degree of purity of the metal. Where this type is impossible, slower corrosion can take place at a rate determined by the diffusion of oxygen to the metal, and comparatively independent of the purity. When a metal is immersed in a solution of potassium chloride, one can observe the production of alkali at the cathodic portions, the production of the chloride of the metal at the anodic portions, and the precipitation of hydroxide where these meet. The electric current can be trapped and measured, and is found (by applying Faraday's law) to account for the greater part of the corrosion actually observed. Generally the cathodic areas are those to which air has free access, whilst the anodic areas are those protected from aeration. It is significant that corrosion usually proceeds most rapidly at the comparatively "unaerated" places—hence the intense corrosion observed in "pits" and over areas covered up by porous corrosion-products.

EXPERIMENTS WITH SOME COPPER WIRE; COHESION A FUNCTION OF BOTH TEMPERATURE AND COLD WORK

By Douglas H. Ingall.

Five samples of copper wire were used representing soft annealed and four degrees of cold work given by 25, 40, 50 and 75 per cent reduction of area by drawing. Each sample of cold worked wire was obtained by drawing one pass from the next thicker wire. The cohesion at elevated temperatures was determined by placing given loads on the wire at atmospheric temperature, heating the wire and determining the temperature at which it broke. All the samples gave similar graphs (plotting cohesion against temperature) in which with rise of temperature the cohesion decreased along a straight line to a constant critical temperature of 350° C., beyond which the cohesion was represented by a sharply descending curve. The equations to the straight lines $C = a - bT$ and to the curves $TC^n = k$ (where C = cohesion and T = temperature) showed that the percentage increase of the constant b and the percentage decrease of the constant n were represented by the corresponding percentage reductions for any given cold worked wire, with the exception of constant n in the 75 per cent reduced wire. Fractures above the critical inflection temperature of 350°C. were brittle in character and intergranular; at the lower temperatures they were normal. At the critical inflection temperature the material was comparatively extremely fragile.

INVESTIGATION OF THE EFFECTS OF IMPURITIES ON COPPER. PART I.—THE EFFECTS OF OXYGEN ON COPPER

By D. Hanson, C. B. Marryat and Grace W. Ford.

This paper describes the effect of oxygen, up to a concentration of 0.36 per cent, on the properties of pure copper. The investigation deals with the casting of the metal, cold rolling, hot rolling, density of chill-castings and rolled bars, tensile tests at ordinary and at elevated temperatures, hardness tests, fatigue tests, notched-bar impact tests, electrical conductivity, microstructures of the alloys in various conditions, and determination of the solubility of oxygen in solid copper.

The results indicate that oxygen has a relatively small effect on the properties of copper and is neither seriously deleterious nor remarkably beneficial. The mechanical properties are not much affected by small quantities of oxygen, and copper containing as much as 0.1 per cent differs very slightly from pure copper. The electrical conductivity, which is usually profoundly affected by the addition of small quantities of an impurity to a pure metal, does not fall rapidly, and values exceeding 100 per cent of the International Standard are obtained in all annealed materials containing less than 0.1 per cent of oxygen. The relatively small effect of oxygen is without doubt due to the fact that the solubility of the oxide in solid copper is extremely low, so low in fact that for all practical purposes oxygen may be regarded as insoluble in solid copper. The oxygen-bearing metals must, therefore, be considered as a heterogeneous mixture of pure copper and finely divided particles of cuprous oxide, and within the range of composition investigated the percentage of copper greatly exceeds that of cuprous oxide. The materials consist essentially of a soft ductile copper matrix, in which harder particles of cuprous oxide are distributed, and the properties of the series are such as would be expected from a mechanical mixture of such constituents.

These conclusions, however, are applicable strictly only to pure copper containing oxygen and free from other impurities. The effect of the simultaneous presence of other impurities may be very appreciable, and requires special investigation, for which the present report furnishes a necessary basis.

HARDNESS TEST ON CRYSTALS OF ALUMINUM

By Hugh O'Neill.

Two pieces of aluminum strip were treated sepa-

rately by their process, but only the first became a single crystal. By accident it was annealed for a short time just below its melting point and upon its upper surface three series of parallel ridged markings were visible. X-ray examination showed that this surface was a rhombic-dode cahedral (011) face, whilst two crystals chosen from the second piece proved likewise to be presenting octahedral (111) and cube (001) faces respectively.

Brinell tests showed that at low loads the different crystallographic planes resist penetration to different degrees, and give indentations of different shapes. In the Brinell sense the (110) face is the "hardest" and the cube (001) face appears to be the "softest." But the load required to immerse the ball—and probably eventually to make it perforate the metal—is apparently the same in all cases. Crystal boundaries were also found to be without any appreciable effect in increasing the resistance of aluminum to penetration. In terms of Meyer's formula, *if a* 1 *mm. ball be used*, then whilst *n* varies from 2.483 for the (001) face to 2.274 for the (011) face *a* is a constant for annealed aluminum. It is independent of the presence of grain boundaries and, in single crystals, of grain orientation.

THE BEHAVIOUR OF METALS UNDER COMPRESSIVE STRESSES

By H. I. Coe.

Compression tests carried out on small cylinders of metals show that with successive increments of loads plastic flow occurs, after the elastic limit has been exceeded, at an increasing rate. Graphical representation shows that at a certain load the ratio of flow for a given increment of load undergoes a more or less abrupt change, very soft metals such as tin and lead becoming perfectly plastic, harder metals becoming more plastic than under preceding loads and immediately succeeding loads. When this particular load is expressed as a stress per sq. in. of the enlarged section of the cylinder it is found that the value obtained agrees very closely with the maximum load per sq. in. in tension of the same material. The term "critical plasticity" has been used to indicate the change in the rate of plastic deformation which most metals exhibit at a particular load.

Annealed metals appear to commence flowing at a comparatively low load and continue doing so at an increasing rate up to the load corresponding to critical plasticity; the same metals, however, in the worked condition, are much more resistant to compressive stresses until they approach near the load corresponding to critical plasticity when they suddenly collapse and a marked temporary flow occurs.

A DILATOMETRIC STUDY OF THE TRANSFORMATIONS AND THERMAL TREATMENT OF LIGHT ALLOYS OF ALUMINUM

By Albert M. Portevin and Pierre Chévenard.

After detailing fully their experimental work, the authors conclude that (1) the application of dilatometric methods, judiciously using the recording differential dilatometer, permits of the study of the transformations and the mechanism of heat-treatment of the light alloys of aluminum-magnesium-silicon, and in general, of alloys containing two phase, univariant transformations, a study which had not been carried out up to the present. (2) The study of the constantant temperature transformations by the differential dilatometer, using a high sensitivity apparatus, leads to general expressions representing the phenomena as functions of time and temperature. (3) The phenomena of quenching and tempering in the aluminum-magnesium-silicon alloys can be interpreted by the known variations in the solubility of Mg_2Si in the solid state, without it being necessary to assume any further transformations in these alloys.

EQUILIBRIUM IN THE SYSTEM GOLD-ZINC (BASED ON INVESTIGATIONS OF ELECTRICAL CONDUCTIVITY AT HIGH TEMPERATURES)

By Professor P. Soldau.

Special attention was paid to the determination of electrical conductivity at high temperatures, which has necessitated the construction of a special apparatus. To check this, it was used for the determination of the transformation temperatures in iron and steel, as most accurately determined by various methods of the physico-chemical analysis.

When the results obtained by the electrical conductivity method at high temperatures and by quenching showed a complete concordance, then that former method could be recommended with sufficient guarantee for the investigation of other metallic systems, and in the first instance such practically important ones as those belonging to the type of brasses.

Foundry Cost Methods

At a meeting of the Cost Committee of the American Foundrymen's Association, held in April, the following fundamental principles for determining foundry costs were agreed upon:

1. Costs should be determined for pounds of good castings produced during stated periods (usually monthly) for individual castings, classes, customers, or the foundry as a whole as conditions may require.
2. Cost factors should be distributed departmentally so far as practicable.
3. In figuring costs of individual castings, classes or customers, certain expenses should be applied specifically. The expenses which cannot be charged directly should be applied partly on the basis of a uniform cost per pound of good castings produced.
4. Costs should be kept according to the way sales quotations are made, that is, either by individual castings, classes or customers. This will make it possible to compare Costs with Selling Prices.
5. Costs should include all expense incident to the manufacture of castings, including interest, depreciation and reserves.
6. Cost estimates prepared for the purpose of determining sales quotations should be based upon normal operation and current market prices. Normal operation means that percentage of full operation which will represent average business, taking into account class of work and facilities. This percentage will be somewhere between minimum and maximum and should never be considered the maximum. The purpose of figuring normal costs at all times is to absorb during periods of good business the idle expense incurred during periods of low production.
7. In making cost estimates for the purpose of sales quotations, consideration should be given to the yield or the percentage of good production to the metal charged. It is believed the importance of yield as a cost factor is not generally recognized by the foundry industry.

Magnesium in the Foundry

A Description of the Methods of Casting Magnesium and Its Alloys. A Recent Development*

By H. J. MAYBREY

THE MELTING OF MAGNESIUM

Magnesium should be melted in iron or steel pots. As magnesium does not alloy with iron to any appreciable extent, it is not necessary to coat the pots, as would be the case with aluminium alloys. The use of graphite pots in melting magnesium is not to be recommended, owing to chemical interactions, resulting in contaminated alloy and short life for the pot.

The free access of air to magnesium or magnesium alloy, and the continual exposure of fresh molten surfaces are conditions favorable to the production of nitrides and oxides. The presence of either of these compounds in a casting, even in small quantities, will have a detrimental effect upon the physical properties of the casting. It is essential, therefore, that means shall be taken to prevent the formation of these harmful compounds.

For the sake of example let it be assumed that it is desired to produce castings in a magnesium alloy of the following composition: 6% aluminium, remainder magnesium.

The melter should take a pot that is perfectly clean, and place a small quantity of magnesium in the bottom of it. He should melt this magnesium taking care that the temperature of his metal does not rise more than a few degrees above the melting point. During this process of melting, a tightly fitting lid should be kept upon the pot. The quantity melted, in this first operation, should be enough to fill the pot about one quarter full when liquid. Fresh lumps of the solid metal, previously warmed, should then be dropped into the molten pool, at such a rate as will allow the metal in the pot just to remain melted. Finally the calculated quantity of aluminium should be added to the melt, and the whole be stirred vigorously enough to ensure a uniform mixture. During the melting, a tightly fitting lid should be kept upon the pot, and only removed for the purpose of adding fresh metal, stirring, etc. These operations should be done in the shortest possible time. If the temperature of the metal is so regulated, its rise in temperature guarded against by pyrometric observation, and air, as much as possible, excluded from entering freely the top of the pot, the alloy can be made up with but a very slight amount of burning.

The temperature of the metal at the moment of casting should be as low as is consistent with the filling of the mould, and the demands of feeding. This temperature is not definite for any particular alloy. It depends upon the type, temperature and intricacy of the mould. Naturally only experience can determine what this temperature should be in any particular cast.

When the metal is melted, and the alloy made up a certain amount of oxide skin is inevitable. This skin must be removed by skimming immediately before casting. It is the author's experience that the alloy should be cast directly from the pot, and not ladled. This means that the amount of metal melted should be sufficient only for the particular work in hand. If a number of small castings have to be made, a small pot should be employed, so that the pot itself becomes, in effect, a ladle.

In order that the temperature of the melt may be controlled with ease, a few remarks about the best type of furnace would not be out of place. It goes without saying that the amount of heat developed by the furnace must be subject to rapid control. Such control is, undoubtedly, most easily obtained in electrically heated furnaces. Unfortunately, we have yet to be convinced that electric melting of metals is universally the cheapest method. Very accurate heat control can be obtained by suitably designed gas or oil fired furnaces. Possibly the best type of gas fired furnace is the one employing natural draught, as a very even heat is then obtained. The injector type gas fired furnaces are apt to be very local in their heating. It is the author's opinion that coke fired furnaces are not very convenient for the melting of light or ultralight alloys.

	Pure Metal		Alloy 6% Al.		Alloy 8% Zn.	
	Ult. stress per sq. in.	Elong. %	Ult. stress per sq. in.	Elong. %	Ult. stress per sq. in.	Elong. %
Chill cast.....	7.9 tons	4	11.5 tons	5	10.8 tons	3
Bottom-poured .	7.3 tons	5	9.4 tons	5	9.5 tons	4
Sand cast.....	6.8 tons	5	8.9 tons	7	9.1 tons	4

From what has been said, it is obvious that the ration of the surface of the molten metal exposed to the air, and the volume of the liquid metal in a pot should be a minimum, in order to lessen the chances of burning. The pots used in the melting of magnesium alloy should, therefore, be designed to ensure this minimum. They should be long, and narrow in proportion.

CASTING IN CHILL MOULDS

It is necessary to cast magnesium into billets, bars, and slabs, as a preliminary to work being done on the metal. Such castings are usually made in chill moulds. The design of these moulds is not radically different from the design of moulds for similar aluminium castings.

When pouring into such moulds, it is as well to prevent the molten magnesium from striking on the side walls, otherwise serious cold shutting and skin folding will result rendering the casting unsuitable.

The whole art of rolling magnesium depends entirely upon the production of a sound slab in the first place. Much effort has been expended upon methods to ensure such soundness as a matter of course. A conclusion arrived at is that the only way in which to guarantee good slabs is by bottom pouring. With a bottom pouring method the temperature of the chill would assume great importance. In fact, it ceases, strictly speaking, to be a complete chill, especially when, as is necessary in some cases, the mould has to be heated to 400° C.

Test bars cast in bottom pouring moulds heated to such a temperature gave figures on test not far removed from those obtained from bars cast in sand moulds.

It would seem unlikely that magnesium alloys are suitable for pressure die-casting. Very excellent results have been obtained, however, from casting the alloy into complicated chill moulds. A very excellent finish is obtained in no ways inferior to similar castings made in aluminium alloys. The design of the die or chill mould follows rules generally to be observed when designing moulds for magnesium alloys.

CASTING IN SAND MOULDS

Every metal has its own peculiarities in the foundry and magnesium is no exception to this. The special conditions obtaining in a foundry devoted to the production of cast iron are not likely to render that foundry extremely suit-

*From a paper read at the International Congress of Foundry, Paris, France, September 12-15, 1923.

able for casting of magnesium alloys. On the other hand, aluminium foundry practice will only require adaptation in certain details. These details are ones of treatment rather than layout.

At high temperatures magnesium interacts very violently with water, and gases are evolved. It should therefore, be the very earnest endeavor of the foundryman to keep molten magnesium and water as far apart as possible. For example, while the metal is liquid in the pot, anything that is brought in touch with it, such as fresh metal, stirring rods, pyrometer ends, etc., should be rendered free from moisture before being placed in the already molten magnesium. It is common sense, therefore, that when the metal is to be cast, precautions shall have been taken to render the mould and cores dry, and free from water in any form.

FIG. 1. CROSS SECTION OF IMPERFECT PISTON

FIG. 2. CROSS SECTION OF IMPERFECT CYLINDER

FIG. 3. POORLY DESIGNED PISTON. NOTE THE HOLE BURNED IN THE HEAD

The mould, etc., may contain water in more than one way. The sand may be damp with rain or added water, or the sand may contain constituents which have combined water in them.

If the mould and cores are baked thoroughly, the water that is mechanically mixed with the sand can be driven off. It is surprising how long the baking takes, and only experience, and sometimes trial and error methods, will tell how long any particular mould requires heating.

It is the author's opinion that coke fired drying ovens are preferable. When gas fired ovens are used, it is of the greatest importance to see that very perfect combusition of the gas is obtained as only then will perfectly satisfactory results be obtained. With incomplete combustion curious blowholes appeared on the surface of the casting. Such holes are shown in Figure I, on the inside surface of the piston. The mould was dried in a coke fired oven, but the core was dried in an oven fired by gas. The temperature of the core oven and the length of time during which the core was baked made quite certain that the core was dry. A probable explanation is that, owing to incomplete combustion the small quantity of hydrocarbons, present in the town gas supply, was condensed on the core and not burnt off. However, this matter which has been a source of much trouble is still under investigation. The present opinion is that it is preferable to use coke fired ovens, which have always given good results.

Fig. 2 is a photograph of a section of a solid cylindrical block, 5" in diameter. The blow holes are due to insufficient drying of the mould. With comparatively large blocks of metal which, after casting, are likely to remain molten for some time, the mould drying process should be carried on for some considerable time.

The type of sand to be used in magnesium founding is a very important factor in the production of good castings. The percentage of clay in the sand should be very low indeed. This will keep the combined water element down. The sand should be of a very open, porous type so that the gases formed during the process of casting can be conveyed away easily. While this is a necessary condition of casting with all metals, it is of extreme importance with magnesium.

A very high silica sand is to be recommended in core making. Any of the ordinary core oils can be used as a binder.

Magnesium being such a chemically active metal, especially in the molten state, it is of the utmost importance that, while liquid, it is brought into contact with materials with which it may react, for so short a time, that no observable effects are produced. It is essential, then, that the chilling effect when the metal is cast shall be a maximum, so that the metal shall be in contact with the sand of the mould for as short a time as possible while it is molten. It has been found, sometimes, in foundries with which the author is connected that there is difficulty in producing a certain casting in magnesium alloy. In such cases it has been found on occasions that at places of large section the metal has remained molten long enough to attack the sand, and there produce a surface on the casting in every way undesirable. It is usually found that the introduction of iron chill in the mould near these places of large section help to reduce, and finally do away with, this chemical attack.

The Bonding Substance of Molding Sands*

By Henry B. Hanley

The paper covers the composition, properties and tests for the bonding substances of molding sands. Chemical compositions are given for the bonding substances of molding sands in the Albany district of New York, New Jersey, Ohio, Illinois, Wisconsin and Pennsylvania. The heat treatment of molding sand containing a bond of organic origin is described. The chemical and physical properties of the bonding substance and the melting point determinations on the grain and bonding substances of various sands are also detailed.

Part 2 covers the bonding or cohesiveness test developed by the Joint Committee on Molding Sand Research. These tests were presented at the meeting of the American Foundrymen's Association in Cleveland, Ohio, April 28-May 3, 1923 (an abstract of which can be found in The Metal Industry for May, 1923, page 183-185).

Mechanical Handling and Preparation of Sand*

By Henry M. Lane

The author describes the mechanical methods of handling sand in the foundry on a large scale. This includes the preparation of sand, its handling and transportation from one point to another and its reclamation. He stresses methods of eliminating hand labor which has always been the great problem with this material in the foundry. Sand can be handled mechanically from the freight cars to the molders and core-makers with very little hand labor if the correct mechanical appliances are used and properly installed.

* Abstract of a paper presented at the International Congress of Foundry Paris, France, September 12-15, 1923.

Pattern Standardization

The Need for This Work and the Possibilities of Eliminating Some of the Unseen Wastes of the Foundry[1]

By E. S. CARMAN*

The nations of the world point to America as being an exceptionally wasteful and extravagant country and as such is rushing headlong into the time when all American industries will be handicapped by the lack of materials with which to continue to provide for her ever-increasing industries with which to supply a constantly growing population.

Waste is in evidence on every hand, from the largest and best managed industry to the smallest and most poverty stricken home; and no line of industry is exempt either in the supplying of raw materials or in the labor consumed in its manufacture. American forests are being consumed four and one-half times faster than their growth, and at the present rate of consumption seventy years hence will find America without forests. An exceptionally large amount of forest consumption is wasted.

Industry in many lines is beginning an intensive campaign for the elimination of waste, but before wastes can be eliminated they must be discovered and pointed out. The Federated American Engineering Societies has contributed a valuable service by the thorough manner in which a well organized committee carried on a thorough investigation in several industries to ascertain the proportional value of the wastes existing. The facts contained in this report were of a startling nature.**

In attempts to eliminate waste it is natural that it should begin with those wastes that are easily observed and outstanding in their appearance. It is, of course, essential that those wastes be eliminated, but it is also as truly essential to eliminate the unseen wastes, for they are as truly wasteful as those that are easily observed.

Therefore, your attention is directed to the unseen wastes in the foundry industry, and not only to the foundry waste occasioned by defective castings, nor inefficiency caused by the lack of skilled workmanship, nor the wasteful hours of the loafer, nor the inadequate and oftentimes absurd methods of handling materials, but rather I would direct your attention to the tremendous amount of waste existing in the foundry operation due to the lack of a system that makes use of standardization in (1) The manufacture of the pattern, (2) The mounting of the pattern, (3) Flask sizes.

It only requires a moment's consideration of present day methods to see clearly the exceptional wastes in: (1) The initial cost of plant and equipment, (2) The continual daily loss in overhead charges, (3) Constant loss of labor involved in production.

POSSIBILITIES IN PATTERN STANDARDIZATION

While these wastes take place in the foundry, the burden occasioned by the waste falls entirely upon those plants that consume the output of the foundry, since the majority of foundries exist solely for the purpose of supplying other industries with castings for their production. Therefore, it seems apparent that the wastes will continue just so long as those industries, that are consuming the output of the foundries, remain uninformed and blinded to the tremendous possibilities of savings to be made by the use of standardization as applied to the patterns which they are furnishing the foundries with which to produce their castings. As an example, the manufacturer of machine tools brings out a new design of machine, turns the drawings over to the pattern shop with no other instructions than to make patterns, and in a large majority of cases they are made without consultation with the foundry as to the best means of producing the castings. This same manufacturer, therefore, when purchasing castings, turns the patterns over to the foundry and the foundry is forced to use them as they are received, and if they are not so made as to be produced on the molding machine they must be made by hand and at a considerably greater expense, and if the pattern fails to fit the flasks at hand a new one must be made.

The additional expense in connection with the producing of the castings must eventually be borne by the manufacturer, and if after he has secured his first lot of castings, he decides, either because of better price or other reasons, to place the patterns in another foundry, this second foundry, upon receipt of the patterns, will have to go through the same expensive routine as did the first one, the cost of which, in this case the same as in the first, must eventually be borne by the manufacturer. If the original pattern has not been mounted on a plate for machine molding there is considerable waste connected with the short life of the pattern since it is conceded that loose and unmounted patterns deteriorate more rapidly than when mounted.

It was with a knowledge of the facts as above set forth that a committee was organized by the societies of the industries interested to make a thorough study of the many problems involved and prepare a classification and standardization of all the factors entering into the elimination of the unseen wastes.

PLAN TO STUDY PATTERN STANDARDIZATION

The committee has adopted a line of procedure as set forth in the following:

(1) Pattern Making.
  (a) Uniform color scheme for the marking of all patterns to indicate cores, stop-offs, machine surfaces, rough castings.
  (b) Core print tapers.
  (c) Drafts.
  (d) Shrinkage.
  (e) Marking.

(2) Mounting the Pattern.
  (a) Mounting the pattern to the pattern plate so that the transfer could be made from one plate to another without re-alignment.
  (b) Flask pin sizes for given sizes of plates.
  (c) Thickness of plates.

(3) Flask Sizes.
  (a) Classify according to:
    1. Steel Plants.
    2. Grey Iron Plants,
    3. Malleable Plants.
    4. Brass Plants.
    5. Aluminum Plants.

[1] From the Bulletin of the American Foundrymen's Association.

*Chairman Joint Committee on Pattern Standardization, American Foundrymen's Association.

**The Elimination of Waste in Industry, McGraw-Hill Publishing Co., New York.

(b) Classify as to type of machine to be used for molding.
(c) Classify as to jobbing or production.
(d) Flask Sizes.
1. Inside dimensions.
(e) Uniform style of design.
1. Minimum dimension of sections

A careful study of this outline will disclose the fact that the result of this investigation will produce tabulated standards applicable to the five different classes of foundries, and that when these standards are used by the manufacturer in the making and mounting of his patterns they will be interchangeable with the standard flasks in not only one foundry but in any foundry to which he may send his patterns.

It is obvious that then the moving of patterns from one foundry to another will not involve the additional expense incident to the preparation for the making of the molds, etc. These standards will also reduce to a minimum the number of flasks with which the foundry will be equipped, and make possible for the foundry to purchase standardized flask equipment such as can be used for any of the jobs coming into the foundry. It is essential with the growing scarcity of materials and ever present labor shortage that haste be made in the preparation of these proposed standards.

It is believed that the industry will readily accept standards in this line and that their use will mean to the foundry industry a saving in trouble, time and money and will produce results which will be comparable to the adoption and general use of such standards as, taps, dies, bolts, bolt heads, twist drills, reamers, gear, teeth, shafting, pulley, etc.

An Old Welsh Copper Works

Written for The Metal Industry by CHARLES A. SMITH

Below is a picture of a copper works in Landore, near Swansea, Wales, which has been running since about 1750. It is still running and it sends copper and Muntz metal all over the world.

The rolling mills operate continuously, day and night, but the casting shop works only one shift.

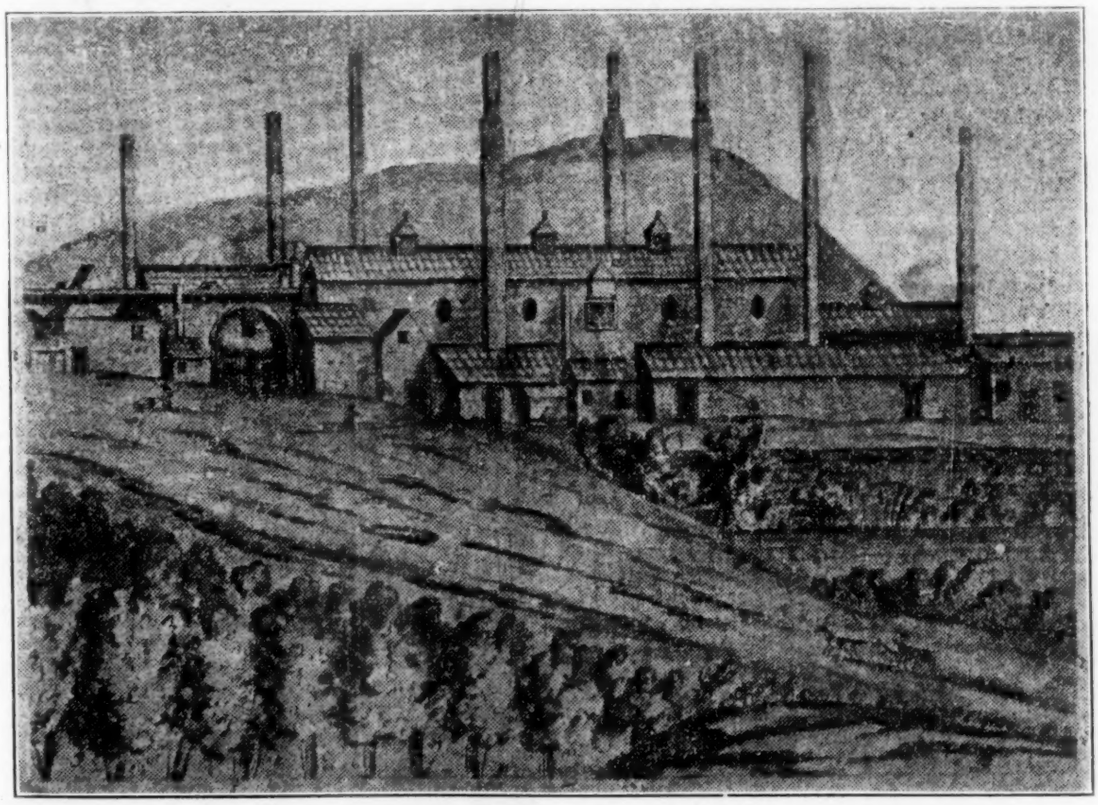
Where they make brass in England or Wales they put up a stack for every 10 pots and the men turn out 40 pots a day in about 8½ hours. The same thing could be done here if the plants were put up right.

Boys are taken into the works at 14 years of age and work their way up until they are roll men. They work alternate weeks on day and night shifts. The day shift starts at 7 a. m., works till 9, breakfasts from 9 to 9:30, works from 9:30 to 1 p. m., lunches from 1 to 2, works from 2 to 5. The night shift comes on at 5:30 p. m. and works until midnight.

A day's work consists of a definite number of plates, and they don't roll large plates to make small sheets as we do in the United States. Neither do they break many rolls. They have large plate mills for big work.

Most of the men know how to grind and set hot and cold rolls in about two hours. They are paid as much as roll men in this country but it costs much less to live in Wales, and they don't have so many bosses.

In these mills they also make their own copper from the ore, which they got, when I was there, from the United States, Cornwall (England), and Spain.



COPPER WORKS IN LANDORE, WALES, RUNNING SINCE 1750

The Coloring of Metals

A Description of the Modern Methods for the Production of Matt and Lustrous Black Finishes and Other Colors on Ferrous and Cuprous Metals*

By ALEX. C. TUCKER

An interesting series of processes has recently been invented by T. Rondelli and Q. Sestini for coloring iron and copper work, in which no reagents containing metallic salts are employed. Four of these processes are now actually used, namely:

(1) The dull black oxidising process, by means of which iron and steel and cast-iron parts may be oxidised a dull black. Incidentally, this process also includes the de-rusting of iron, steel, and cast-iron parts and their preparation for enamelling, painting, etc.

(2) The color oxidising process, by means of which iron, steel, cast-iron and malleable iron parts may be oxidised in various colors, from an imitation of yellow brass to a dark-brown color.

(3) The copper or brass oxidising process, which is similar to process 1, but which provides for the oxidation of copper to a dull black, capable of being polished to a shiny black, and very resistant to chemical action.

(4) The shiny black oxidising process, by which steel, iron, and cast-iron parts may be oxidised to a brilliant black.

In the first three of these processes an electric current is used; but none in the last. The colors produced are due to oxides or salts of iron (or copper) in films so thin that they cannot be measured even by the aid of a microscope. Their thickness is said to be of the order of half a wave-length of the violet end of the spectrum.

In the electrolytic processes the articles to be colored are submitted to anodic oxidation in a bath of strong caustic alkali. The color of the surface obtained depends on various factors, such as the strength of alkali solution used, the current employed, the time of immersion, and the temperature.

DULL BLACK ON IRON AND STEEL—MAGNETIC OXIDE.

In the dull black oxidising process the electrolyte, which consists of a sodium ferrite, is formed by using a sheet of iron a little less in area than the long side of the bath as an anode in a caustic alkali solution, a current of about 45 amps. being used for each square foot of the sheet; on reversing the current every few minutes for about an hour a sodium ferrite is formed and the bath is ready for production work. The progressive dissolution of the iron is shown by the reading of the voltmeter. The ammeter must have a capacity up to about 1,000 amps., while the voltmeter should read on a large scale to 3. Both instruments must have a double scale for reading in either position of the reversing switch, and both should be always visible to the operator.

At the beginning the voltage stops at a point under 1 volt for a very short time before reaching the stable value of about 2 volts. This is a direct reading of the polarisation phenomenon, and the intensity of this polarisation increases as the formation of sodium ferrite increases. A good bath requires, at a current density of 5 amps. per square decimetre, two or three minutes' depolarisation period.

Electrical leakages may occur in two ways: First, through the splashing of the electrolyte on the top of the tanks, thus causing short-circuiting, and, second, through using unsuitable carriers for the work, since any undue exposure of surface will cause a short circuit. Economy of current is effected by the use of a counter-electrode, by which the internal resistance of the electrolyte is reduced and the work is more efficiently done. This counter-electrode further prevents corrosion of the tank itself, and in order to maintain the circulation of the electrolyte it is perforated and placed centrally in the tank, so that work can be arranged on both sides of it, so doubling the output.

The ferrites and ferrates of the alkalis may be regarded as compounds of the type $NaFeO_2$ or $Na_2Fe_2O_4$ and Na_2FeO_4, respectively. Under the action of the powerful currents used in the processes, however, entirely different compounds are probably formed, and it would seem that the ferrite on which the processes depend corresponds with the formula Na_2FeO_2; it is a greenish-white substance not easily obtained in the solid state. It differs from the ferrite obtained by Haber and Pick in that it is fairly stable on dilution with water, provided it is protected from oxidation. In this way a considerable amount of iron can be held in a solution of the ferrite—sometimes as much as 10 g. of iron per litre in a solution of caustic soda boiling at 140° C.

A solution of ferrite as obtained from the electrolytic preparation and subsequent working of the bath never contains so much as 10 g. per litre; the amount actually varies from 1 to 3 g. per litre when the bath is working properly, and the solution is generally of a greenish color, owing to traces of sulphur removed from the steel electrode. This ferrite is readily oxidised and is converted to ferrate by exposure to air or by sodium peroxide, etc.

The ferrate can be converted into ferrite by boiling with metallic iron, and hence when such solutions are boiled in the tanks the electrolyte automatically becomes a ferrite. The two compounds may be distinguished analytically when separate by adding a small amount of an alkali sulphide, which, in the case of the ferrite, gives an intense green, while the ferrate will give a deep orange coloration.

If a ferrite solution in an excess of caustic soda is kept at the boiling point in the presence of metallic iron and kept freely exposed to the atmosphere in order that it may absorb oxygen, a part of the ferrite will be converted into ferrate at the surface of the bath and again reduced to ferrite by the metallic iron; or, if the concentration of ferrite is already fairly high, magnetic oxide is formed, and, being insoluble, separates.

RESISTANCE TO RUST.

Although the surface produced on the iron articles is the magnetic oxide, Fe_3O_4, and therefore is not capable of absorbing oxygen, the articles treated are unfortunately not entirely rustproof. It would appear

* From a paper presented before the Birmingham (England) Section of the Society of the Chemical Industry.

that the surface, like nickel-plating, is pervious to moisture and carbonic acid, and therefore in such atmospheres will rust slightly. The rusty appearance can generally be removed by rubbing, but it re-appears on further exposure; the surface is otherwise unaffected. On the other hand, these surfaces are more resistant to rusting than those produced by any other process that I know of, with the exception of the old Bower Barff process. This process depended on the formation of a quite thick coating of magnetic oxide, so thick that it was brittle and peeled.

Polarisation of the bath by the current occurs, and consequently depolarisation is necessary to obtain the best efficiency; thus, with 45 amps. normal current for the first batch of work, the polarisation action produces a back E.M.F. which has to be neutralised by a reversal of current. This occupies about four minutes, according to the character of the work being treated. All these actions and reactions are accurately recorded on the switchboard. The processes, therefore, are under exact control.

IMPORTANCE OF POLARITY.

As a consequence of the development of polarity, in practice it follows that the position of the work in the bath becomes important; thus, if articles like an ordinary shifting jaw spanner are to be blackened, the jaws must face the counter-electrodes. Again, a field magnet for magnetos must be so arranged that the magneto field will not interfere with the dynamo current.

The difference of polarity between soft and hardened steel seems to affect the process, and a higher current density is required when hardened steel is being treated. At the end of the depolarisation period the c.d. at the poles of the cell rises considerably, and this point coincides with the formation of a stable film of magnetic oxide on the electrode.

A practical proof of the absence of corrosion or coating is that all wing nuts and bolts used in the carriers on which the work is clamped to ensure good electrical contacts have been in use for many months, and have been oxidised and deoxidised certainly twenty times a day. The threads of the screws appear to be quite unaltered except for mechanical wear, and the other parts of these screws are as good as when new, though they are black.

PRODUCTION RATE AND QUALITY OF COATING.

The rate of production of these processes is illustrated by the fact that one boy can treat and finish 12,000 sparking plug bodies per day or 300 spanners. These figures are, of course, on repetition work, when special carriers are used.

The hardness of the colored iron surfaces is remarkable; they will stand any reasonable bobbing, but not, of course, emery, etc. The black copper oxide surface is also remarkably hard. It is unaffected by sulphur from gas, rubber, etc., and so forms a very fine surface for motor lamps, horns, etc., when high finish and durability are required.

In the practical working of the process, solution of the iron is practically limited to one of the electrodes and precisely to that part of the tank which is called the counter-electrode. The quantity of iron dissolved from the counter-electrode is in all cases very minute.

Further action of the current causes the electrode to become passive again, but it is important to note that the time required to produce this effect varies according to the temperature of the bath, the current density, and, above all, according to the treatment which the electrode has previously received.

Rust, on coming into contact with the boiling ferrite solution, is partly dissolved and converted into magnetic oxide. A certain amount of reduction of the rust is due to the reaction between iron and ferric hydroxide in presence of water, by which the layer of rust immediately contiguous to the iron may be converted into Fe_4O_4. This process is slow at ordinary temperatures, but becomes discernible at the temperature of the bath. It is, it seems, connected with the ability of the ferric hydroxide to be or become present in a colloidal condition. Magnetic oxide, resulting from the action of the bath on the rust, is very easily reduced by cathodic reduction to metallic iron.

PRACTICAL OPERATING FACTS.

The normal cycle for the oxidising of parts in the electrolytic tank consists of four periods. In the first the reversing switch is placed in such a position that the parts and the carrier holding them act as cathodes or negative pole. During this period rusty objects are reduced and therefore de-rusted, whilst machined surfaces are covered with a thin coat of iron. At the end of two or three minutes the current may be reversed. The parts and the carrier are now acting as anode or positive pole. The fine coating of iron which was deposited during the last operation is re-dissolved, and the moment the whole of the coat has gone into solution the surface of the parts is transformed into black magnetic oxide. It will be noted that the voltage, which had remained constant at about 0.8 volt during the beginning of the oxidising period, rises first slowly and then rapidly to 1.9 volts. This denotes the end of the first oxidising period. The current is then once more reversed and the oxide formed is reduced. This second reducing period lasts as long as the first, and at the end of it the reversing switch is again manipulated and the parts made positive.

The time taken for the oxidising period to be completed depends upon the concentration of the ferrite in the bath and the length of the negative period, but as a rule it is about three minutes. The total time for the complete de-rusting and oxidising of an average steel part is therefore ten to twelve minutes. The carrier containing the parts once oxidised is taken to the first rinsing tank, where all are swilled.

Parts which are machined and not rusty or scaled do not, as a rule, require a complete cycle of reversals, one single negative and one positive period being sufficient.

Acetylene-welded tanks are used, as it is found that riveted tanks will not withstand the strong soda solutions and repeated heating and cooling. These tanks are heated by gas and are electrically insulated in order to economise the heavy currents used.

In addition to the soda tanks, supplementary tanks are required. The first is the recuperating tank, which contains hot water, for removing the adhering solution from the treated work; the water becomes increasingly alkaline and is used in the process tank for replacing that lost by evaporation; in this way some 90 per cent of the original reagents is recovered. The work from the process tank being above 100° C. will, on reproduction work, generally keep the recuperating tank hot enough without supplementing by gas. The next tank is a swilling tank, in which the work is further washed also in boiling water, after which it is put into an oil tank containing vegetable or other suitable oil, which saponifies any traces of soda left on the work.

WASHING SODIUM SALTS FROM IRON.

The difficulty of thoroughly washing sodium salts

from iron is much greater than might be anticipated. Steel goods hardened in molten salt in the ordinary way, and washed in hot water, have been known to develop white deposits and local rusting. It was found that nothing short of boiling in water would remove the salt.

The current to be employed is 45 amps. per sq. ft. of surface to be treated, and allowance must be made for the current used up by the suspension, which, however, for a well-designed suspension is very small. In general, it may be stated that all cast-iron, malleable iron, steel and wrought iron parts can be successfully oxidised. They can be treated if covered with rust and with mill scale oil, and oil plants in moderate quantity. Ordinary wrought iron and mild steel parts offer no difficulty in being treated, but special steels, such as some chromium and tungsten alloy steels, show a tendency to oxidise to a brownish-black tinge and not to a deep flat black. This tendency can be overcome by the prolongation of the reducing and oxidising periods and by increasing the current flowing through the objects per sq. ft. of area. The final oxidising period, however, in this case should not be made longer than is indicated by the rising of the voltage. As soon as the voltage has reached its maximum the current should be cut off and the parts withdrawn.

COLOR AND COPPER OXIDISING PROCESSES.

The color and copper oxidising processes are simply variations of the conditions of working the above solutions.

LUSTROUS BLACK FINISH.

No electric current is used in the shiny black oxidising process, oxidation being affected by an alkaline bath containing an oxide of a metal electro-negative to iron, so as to produce oxidation of the iron surface with separation of the metal of the oxide used.

The electrolytic tank is replaced by a plain lead-lined steel tank. The tank arrangements and the subsequent tank layout remain the same.

The parts in the treatment bath may be hung from loose wires or from a very light and cheaply constructed frame carrying a number of hooks from which they may be suspended. They may also be treated in a wire basket of wide mesh or tumbled, if of very small dimensions, to facilitate the action of the bath. The carriers or suspensions may be entirely dispensed with if the number of pieces to be treated does not warrant their construction. In this case pieces may be immersed in the bath from wires or placed in a basket of wide mesh. The amount of iron, apart from that of the tank itself, which is introduced into the bath in the form of carriers or baskets, should be as small as possible to prevent waste of chemicals and troubles in oxidising; hence, all appliances should be designed as light as possible.

The bath used for this process is composed of a solution of sodium plumbite in an excess of sodium hydroxide (caustic soda). The introduction of the plumbite is carried out by adding litharge to the boiling soda solution. It is advisable to stir the litharge with a small quantity of the caustic soda solution to the consistency of a creamy paste. This paste is then easily dissolved when added to the boiling bath of sodium plumbite in caustic soda.

The parts which are to be oxidised must have a well-finished or bright surface if they are to be oxidised a deep brilliant black. The color and brilliancy of the final oxidising depends chiefly upon the condition of the parts before treatment. A rough surface, such as that of an ordinary stock screw for wood, will, of course, oxidise, but instead of assuming the desired deep brilliant black the coating will have a bluish hue.

It may be assumed that the plumbite formed in the process corresponds to the formula Na_2PbO_2 as long as it is in the presence of metallic lead (the lining of the container in this case). Under other conditions the formation of several compounds differing in hydration and molecular arrangements is possible. These, however, behave quite differently towards iron. The fundamental reaction of the process is the reduction of the plumbite by iron thus:

$$4Na_2PbO_2 + 3Fe = Fe_3O_4 + 4Pb + 4Na_2O.$$

It is probable that intermediate reactions occur. It is almost certain that the tendency of the iron to dissolve as ferrite—instantly converted into ferrate by the oxidising medium—and the interaction between ferrite and ferrate play an important role in the process.

Barbedienne Bronze

Q.—Will you kindly tell us what a barbedienne finish is?

A.—Bronze barbedienne is a beautiful brown color. The finish has been used for a century principally as a finish upon works of art, such as bronze statuary, etc., so termed, which are made of a rich brass alloy. A considerable amount of such art goods are cast from spelter, heavily brass plated, and then finish with the barbedienne finish. The finish is supposed to have originated in France.

It requires considerable experience in metal coloring to produce this beautiful brown finish, chemically. The results to-day are obtained by pigment lacquers. Very good results, however, are obtained by this method. The prominent lacquer manufactures produce barbedienne colors for spraying purposes.

There are two methods of chemical coloring used for French Art Bronzes, as follows:

1st: Arsenous sulphide is dissolved in water ammonia, 26%, heated to 100 degrees Fahr. or more. The solution will become a deep yellow color with a slight turbidity. The brass articles to be bronzed should be suspended in the mixture. They become first golden yellow, then brown—the finish, when it comes from the solution with a dark dirty shade. The articles should be washed and dried in cold and boiling water, and the surface lightly scratch-brushed with a worn brass brush. The operation should be done dry. If the color is not satisfactory repeat the operations. Afterwards lacquer and wax. Do not prepare any more solution than is necessary, as it soon decomposes.

2nd. The second method consists of an application of a mixture of three parts pentasulphide of antimony, which is a golden sulphuret of antimony and 1 part of finely divided blood stone brought to a not too thick fluid pigment by mixing thoroughly with hydrosulphuret of ammonia.

The pigment thus prepared is applied to the articles with a soft brush uniformly. They are then dried and lacquered over. The dry powder resulting should be removed with a soft brush. The barbedienne finish will be found beneath. Finally lacquer and wax.—C. H. Proctor.

Etching

Some Methods of Etching Various Materials

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor

ETCHING ALUMINUM NAME PLATES

The production of aluminum etched name plates is somewhat more difficult than the production of copper or brass name plates, not so much in the etching process, but in the difficulty arising in producing a satisfactory uniform black color in the backgrounds. Some firms use an enameled background but the method is not as satisfactory as one that can be used chemically in applying the black either by simple immersion or by electroplating. As aluminum cannot be colored black by immersion solutions, it is necessary to use a black nickel solution in the production of the black. This method is now used by the majority of name plate manufacturers.

On page 20 of "Platers' Wrinkles" will be found two black nickel solutions that will give excellent results. In preparing the solutions, use one-third of the water prescribed first at 180° F. and dissolve therein the salts in the order given, then add the balance of the water cold. The voltage should not exceed one volt—the amperage per sq. ft., low. It will require from 15 to 30 minutes to give a uniform black deposit at two to three amperes.

Use nickel anodes; about two small brass anodes will help to keep the zinc in the solution normal. The acid used in etching aluminum is muriatic acid diluted as may be required with water. Hydrofluoric acid can also be used.

ETCHING GLASS

There are three commercial methods of etching glass, as follows:

1. By means of the glass etcher's engraving wheel, which requires manual skill.
2. By the use of a stencil prepared from soft rubber or paper and sand blasting by air pressure, using powdered pumice stone, ground glass or silica glass sand as the abrasives.
3. By etching with solutions of hydrofluoric acid, such as ammonium or sodium fluorides.

For an etching fluid other than the above, prepare a solution as follows:

Ammonium Fluoride .....½ oz.
Barium Sulphate .....½ oz.

These materials should be reduced to a fine powder. Place in a lead dish and add hydrofluoric so as to produce a fluid solution.

ETCHING SILVER-PLATED CUTLERY

The method of etching silver-plated cutlery consists of the following:

1. A rubber stamp made for the required design.
2. A heavy black mineral ink or a solution of gum guiacum dissolved in acetone to a varnish consistency for the stop off.
3. A pad of good dimensions, similar to a rubber stamp pad, for holding a strong solution of caustic soda.

1 part caustic soda, 2 parts water.

The caustic soda is used to reduce the ink or gum guiacum varnish.

4. Running water to remove acid or caustic soda.
5. Mixture of nitric acid and water as the etching fluid.

Manipulations: Arrange the steel knives.

1. In holders so that the location of the etching will be the same always.
2. Apply the etching ground, ink or varnish, and allow to dry.
3. Apply the rubber stamp to the steel knife which is moistened with the caustic soda solution from the pad.
4. In a short time the caustic soda eats away the ink or varnish, leaving the steel bare with the surface for etching.
5. Wash thoroughly, then apply the etching acid to the steel knife and etch as deeply as desired. If a weak current of air is deflected on the knife during the etching operation, then the gas bubbles will be constantly moved and the etching will result more rapidly. The transfer method of etching is also used extensively. This consists of stamping the design on special white sun bleached tissue with heavy printers' ink. While the ink is moist, the tissue paper is applied to the surface to be etched. When dry, the paper is removed by moistening the back of the paper with denatured alcohol. The ink is left on the metal and acts as the etching ground and is ready for the acid. Special forms of rubber are made to hold the acid in position on the metal to be etched.

ETCHING AND EMBOSSING PENCILS

There is very little if any etching done upon most of the self-sharpening pencils. The majority of the presumed etched work is nothing more than very elaborate embossing by the aid of steel dies of the roller type. One large concern formerly had the tubes manufactured and embossed by Providence, R. I., firms, but at present is doing all this work for itself. Communicate with some firms who manufacture pencil tubing in karat golds, silver and rolled gold plate as well as brass tubing which is afterwards electro-plated.

On high grade pencils some hand engraving is done by practical jewelry engravers. Etching is accomplished by the transfer method of applying the design, and solution of nitrate of iron is used as the etching medium. You might be interested in the two following articles printed in THE METAL INDUSTRY some years ago which cover etching of silver pens and articles of brass and copper. "Silver Ornamentation of Fountain Pens," THE METAL INDUSTRY, page 241, July, 1909. "Etching Solutions for Brass and Copper," THE METAL INDUSTRY, page 132, April, 1909.

ETCHING STAINLESS STEEL

Q. We are encountering some difficulty in etching Stainless Steel, due to the fact that the varnishes which we use do not sufficiently resist aqua regia, the etching acid.

A method of etching has come to our attention, employing the principle of double varnish etching, but where a steel stamp and a chemically prepared paper are used in marking instead of the rubber stamp moistened with caustic.

A. You do not state the type of varnish you are now using as a resist. If you had sent us the data some modifications might have been made to such a varnish that would have overcome the difficulty you now experience in etching stainless steel with aqua

regia. We presume you use the rubber stamp and caustic soda method. In such an event, an asphaltum varnish mixture would be out of the question.

The method you refer to in your second paragraph is the transfer method of etching. It consists of having a lithographic stone prepared with the desired name, trade mark, etc., engraved upon it. The stone is inked by the usual small printers' inking roller. A heavy black metallic ink is used as the ink factor. The impression is taken from the stone upon a special bleached tissue paper while moist applied to the steel to be etched, the inkside down. The ink is allowed to dry. The tissue paper is moistened with denatured alcohol which releases it from the ink impression. The usual application of the etching acid can then be made to the steel.

Chemical Exposition

Points of Interest to the Metal Manufacturers at the National Exposition of the Chemical Industry

The ninth National Exposition of the chemical industries was held at Grand Central Palace, New York City, September 17-22. The Exposition was of somewhat different character from what it has been in the past. A larger proportion of the exhibitors showed equipment and supplies than in previous years. As a consequence, the exposition was more than usually interesting to those engaged in metals and metal manufacture.

To list those concerns which use metals in one form or another would be to include practically all the exhibitors, for in one form or another they all required brass, bronze, lead, tin, zinc, aluminum, etc., in their equipment. There were, however, aside from these, an unusually large number of exhibitors who made equipment and supplies which are used by the nonferrous metal trades. A list of these manufacturers and their products is given below.

As a part of the program, meetings were held on Wednesday and Thursday, September 19 and 20. Motion pictures were shown daily at 2 p. m. and 7:30 p. m. and among them was a five-reel picture showing the operation of a nickel rolling mill producing sheet and wire, shown by courtesy of the International Nickel Company.

EXHIBITORS

John F. Abernethy, Brooklyn, N. Y. Chemical lead burning and lead lined tanks.

American Cyanamid Company, New York. Cyanamid for plating.

American Tank & Welding Company, Belleville, N. J. Electrically welded and riveted tanks for plating.

Anaconda Copper Mining Company, New York. Copper from ore to ingot and alloys of copper in all shapes and for all purposes made by the American Brass Company.

Baker & Company, Inc., Newark, N. J. Platinum laboratory ware and apparatus.

Bristol Company, Waterbury, Conn. Pyrometers for melting and heat treating metals.

Brown Instrument Company, Philadelphia, Pa. Pyrometers for melting and heat treating metals.

Bureau of Standards, Washington, D. C. Samples of work done by the Bureau with sprayed metal and also with electroplating of various metals.

Calorizing Company, Pittsburgh, Pa. Calorizing for protection of metals against high temperatures.

Carborundum Company, Perth Amboy, N. J. Carborundum refractories for furnaces of all sorts including metal melting and heat treating.

Celite Products Company, San Francisco, Calif. Sil-o-cel, an insulating brick for use in furnaces.

Clark Trucktractor Company, Buchanan, Mich. Clark "Truclift," a gasoline powered elevating platform industrial lift truck.

Commercial Solvents Corporation, Terre Haute, Ind. Butanol and other chemical products.

Dings Magnetic Separator Company, Milwaukee, Wis. Magnetic separators for removing iron from scrap metal.

Egyptian Lacquer Manufacturing Company, New York. Lacquers for finishing and preserving metals of all sorts, and wood.

General Bakelite Company, New York. Bakelite products and lacquer.

General Electric Company, Schenectady, N. Y. Electrical equipment of all sorts from heat treating and metal melting to accessory equipment for driving machinery.

General Tank Corporation, Brooklyn, N. Y. Wooden tanks for plating.

Great Western Manufacturing Company, Leavenworth, Kan. Gyratory sifting, screening and cleaning machinery for use on foundry sand, etc. Distributor, Charles F. Murphy, 306 Greene Avenue, Brooklyn.

Hardinge Company, New York. Hardinge conical mill for wet and dry grinding.

International Nickel Company, New York. Nickel and Monel metal products of all kinds.

Leeds & Northrup, Philadelphia, Pa. Pyrometers for metal melting and heat treating.

Lowe Manufacturing Company, Detroit, Mich. Sifting machine for foundry sand, etc.

Maas & Waldstein New York. Lacquers for finishing and preserving metals of all sorts and wood.

Norton Company, Worcester, Mass. Refractories for grinding machinery and for heat resisting.

S. Obermayer Company, Chicago, Ill. Refractory cements for metal melting and heat treating furnaces; also general foundry supplies.

Palo Company, New York. Meker metal melting and heat treating furnaces.

Pittsburgh Testing Laboratory, Pittsburgh, Pa. Chemical and physical testing and consulting service.

Pusey & Jones Company, Wilmington, Del. Hybnickel alloys for various purposes, including pots for melting aluminum.

Quigley Furnace Specialties Company, New York. Hytempite, a refractory cement for use in furnaces of all sorts.

Sholes, Inc., New York. Monel metal fabricated products and safety acid handling carboys.

Westinghouse Electric & Manufacturing Company, E. Pittsburgh, Pa. Electrical equipment of all sorts from heat treating to accessory equipment for driving machinery.

Young Brothers Company, Detroit, Mich. Industrial ovens for japanning, enameling, core-baking, etc.

Zeller Lacquer Manufacturing Company, New York. Lacquers for finishing and preserving metals of all sorts and wood.

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ADDRESS ALL CORRESPONDENCE TO
THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK
Telephone Number Beekman 0404. Cable Address, Metalustry

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Contents

EDITORIAL

METALS AND THEIR USES

Recently the United States Department of Agriculture warned the public against the use of galvanized or zinc-coated iron utensils for food and drink. Officials of the Bureau of Chemistry stated that the zinc would probably dissolve and would not only give the food an unpleasant taste but would probably cause illness. This fact has been verified in the case of root beer, lemonade, orangeade, milk, carbonated water, Washington, D. C., city tap water and distilled water, held over night in zinced iron buckets. The Bureau adds that it would be unsafe to use such utensils for making preserves or jellies or as a container for cider or other fruit juices.

The same statement has been made by Wiley & Company, Inc., Baltimore, Md., consulting chemists, who state that although very little zinc would be dissolved by the action of water, nevertheless, the common acids contained in fruit juices, such as citric, tartaric and malic would attack the zinc. It seems that we may be sure of the unsuitability of zinc-coated utensils for food containers. This is no reflection upon zinc, however. It simply means that zinc has other spheres and other work to do. It is still one of the best materials for protection against weather, and when properly applied, in sufficient quantity, zinc-coated metals are among the most highly resistant to atmospheric corrosion of the commoner metals.

The most popular material for food containers is still tinplate. Copper was, of course, used extensively at one time and is still in use in large kitchens, but, like iron, it has to be tinned. There seems to be some difficulty about even the use of tin in food containers and cans, due to the black spots and discoloration found in the food. As stated in an editorial on this subject in our September issue, the problem has been taken up by the Bureau of Standards, the Bureau of Chemistry and the tinplate and can manufacturers.

The outstanding development of metal for contact with food products during the last decade or two, has been the spread of aluminum for kitchen ware. It is safe to say that aluminum has revolutionized this industry. Copper once was widely used but is now restricted largely to kitchens for large organizations, such as hotels and steamships. Even agate ware is far behind aluminum in popularity for this use. Aluminum, although difficult to keep bright is nevertheless very satisfactory because of its light weight, safety from the standpoint of sanitary considerations, and the fact that it does not chip or permit materials to slough off into the food which it contains. The gray oxide coating, once so objectionable, is now ignored since the public has been educated to understand that this is harmless, and in fact a protective agent against deterioration.

Nickel and Monel metal have made considerable strides into the field of food containers but so far, at least, their high cost has prevented them from entering into common everyday use. It seems that they serve excellently in large kitchens, however, and have, therefore, broad possibilities.

It is interesting to find that in spite of the fact that it is necessary to guard against contamination of food by metals, these same metals are found closely associated with the so-called vitamins in plant and animal tissue. According to a report from Science Service, Prof. J. S. McHargue, research chemist of the Kentucky Experiment Station reported having found appreciable amounts of lead, arsenic, copper, cadmium, manganese, zinc, nickel and cobalt in virgin and cultivated soils from three different geological formations in Kentucky. Plants and seeds growing under natural conditions were also examined, and copper, manganese and zinc were found in all cases. In wheat, corn and rice, these three elements and also iron were discovered. The most important organs and tissues of hogs, sheep and cattle were examined and the largest amounts of copper, manganese, zinc and iron were found in the liver of each of these animals.

PLATERS AND THE NICKEL ITCH

An announcement of the utmost importance to platers is made in the September issue of the Monthly Review. The Boston branch of the American Electro Platers' Society has appointed a committee consisting of Messrs. Herrick, Gale and Williams to investigate the nickel itch, which has always been the bane of the plating industry, and to determine first, the best treatment, second, a cure, and third, a preventive. The results of the work of this committee are to be published in the Monthly Review for the benefit of the entire membership of the Society.

The progress made so far consists of working with Professor Cheever of the Massachusetts General Hospital who has in charge six cases in Boston. It is stated that in every case it has been necessary to take the victim out of the plating room in order to get the proper treatment or effect a cure. Much information has been given to the committee by large manufacturing plants who have found remedies of their own.

The committee has appealed for information from anybody, in any place, on the subject of the nickel itch. In particular, the committee desires answers to the following questions:

1. Do you know of a case of itch or rash among men working over a sulphuric or hydrochloric acid pickle? If you know of such a case give a careful description of it, and just how it compares with nickel itch.
2. Do you know of a case of itch or rash resembling nickel itch, contracted by a man working in or around a plating room, but not over the nickel baths?
3. What type of men in your experience contract nickel itch?
4. What treatments for nickel itch do you know of?

It is suggested to those who are in large plants maintaining hospital departments or other attendants, that they go at once to the doctor or nurse and obtain all possible information to be forwarded to the committee, sending the name of doctors who have treated nickel itch, and if possible, copies of their prescriptions written by the doctors, in order to avoid mistakes.

THE METAL INDUSTRY earnestly requests the full cooperation of its readers in this work, whether or not they are members of the American Electro-Platers' Society. We have published, a number of times, a remedy for the nickel itch recommended by C. H. Proctor, our plating-chemical editor. This remedy is as follows:

Procure some perborate of sodium and peroxide of zinc; both of these materials contain the antiseptic properties of peroxide of hydrogen or dioxogen in their purest form. When using the materials, first wash the hands thoroughly in luke warm water, dry thoroughly and then immerse in a warm solution of perborate of sodium and water in the proportion of

Water	2 quarts
Perborate of sodium	¼ ounce

Immerse the hands in the solution for three to five minutes. Then dry thoroughly and each evening before retiring apply the peroxide of zinc in the form of an ointment. This ointment should be prepared as follows:

Procure some lanolin or white vaseline and add a sufficient amount of peroxide of zinc to form a thick paste or ointment. Rub this ointment into the sores. Continue these applications until the sores are entirely healed.

I would suggest that the men obtain peroxide of zinc soap and use it when washing their hands. If the blood is kept cool by the aid of a quarter of a teaspoonful of rochelle salts in a tumbler of cold water taken each evening before retiring, it will help a great deal to keep the blood in condition.

We ask that all of our readers who have had any experience with this infection, forward their remedies or any other results of their experience to us, to be passed on at once to Mr. Herrick. The problem is one of utmost importance to all practical working platers. It is high time that a thorough study was made and, if possible, the difficulty overcome by concerted effort. THE METAL INDUSTRY offers its full co-operation in this work.

OCEAN CABLE

During the month of August, it was noted in the daily press that Col. George S. Gibbs, U. S. A., had sailed for Europe with Col. Frank J. Griffin to make arrangements for the manufacture and purchase of a new cable to be laid from Seattle to Alaska. According to Col. Gibbs' statement the work of laying the new cable is to be done by the Signal Corps of the army and bids were opened for its manufacture in Washington on August 1, 1923. Most of the bids came from England. It seems that the system from Washington to Alaska includes 2,000 miles of ocean cables and 1,400 miles of land lines.

The point that interested us particularly was the fact that it was necessary for the American army to go abroad to buy ocean cable for use in the United States. An opinion from a prominent cable manufacturing company in this country, states that there has never been any large scale production of ocean cable in the United States; that the production of such cable in a large way would necessitate a different plant from any of the American cable plants and that the established foreign manufacturers who have specialized in that field, particularly the English, have an advantage in production costs that makes the field unattractive to American manufacturers.

Of course, it is hardly to be expected that any country whether it is the United States or a European nation could produce all of its own necessities. It is true that English manufacturers have been making cable for generations before Americans. It is no reflection on American initiative to admit this fact because there are such obviously good reasons for its existence. Nevertheless, we believe that it would be to the interest of American manufacturers to consider this field for the future, and perhaps the not far distant future. It is understandable that small quantities of very special material would be better obtained abroad from those already equipped to make it, than to attempt its manufacture here, but when this special material runs up into such large tonnages of copper and lead, it would seen the policy of wisdom, at least to consider the policy of providing for our own needs. With no reflection on the cable manufacturers of this country, but rather because of our respect for the long strides they have already made, we contend that eventually ocean cable for use in the United States should be made in the United States.

FAILURES

A recent failure of a Connecticut concern dealing in platers' and polishers' supplies should point a moral to all those connected in any way with this industry (incidentally, ourselves). There are, of course, failures and failures. Some are honest but caused by bad management; others are caused by circumstances beyond the control of those involved. There is, however, a type of failure which is not only traceable to bad management, but can be called almost premeditated. Consider the man who enters a certain line, undersells his competitors to such an extent that he operates at a loss, inevitably goes into bankruptcy, pays his creditors a fraction of the amounts due to them, and then starts up in the same line of business, under a different corporate name, in another state. Instead of having learned a lesson, he pursues exactly the same tactics which brought him to bankruptcy in the first place, with the same result. Far from having the true aspects his business career brought home to him, he continues his practices and goes through bankruptcy perhaps three or four times.

This procedure, of course, covers a number of years. Eventually the man becomes known as a dead beat, but the extraordinary thing is that he continues to get credit and continues to live on his income from enterprises which fail, one after the other. It opens up an entirely new industry, namely that of getting along by successive failures. To be sure this industry is closed to men who have a sense of honor and who value their reputations and business friendships. Fortunately, business men of this class are very few or business would be a much more precarious undertaking than it is. Nevertheless, there are a few such and they should be carefully watched. Anybody may fail once but beware of the man who makes bankruptcy his profession.

PROHIBITION AND INDUSTRY

Very few public questions have aroused the heated and long continued argument that the prohibition amendment has caused. The Volstead act has resulted in more disagreements than it seemed possible to have on any one question. The amendment can be looked at from any one of a number of ways. From a personal standpoint it is either an infringement of one's liberty or the safeguard of numberless wives and children. Laying aside for a moment, the personal or human element, however, it was of unusual interest to business men to read the interview published in the New York Times, July 1st, 1923, by Judge E. H. Gary, Chairman of the Board of the United States Steel Corporation. Probably no one in the country commands the respect from the business public that Judge Gary does. It is, of course, everyone's privilege to disagree with anyone, but Judge Gary's opinion on business matters is always heard with respect.

Briefly, he states that prohibition has been of incalculable benefit to workers and their families in American industry, particularly those in the steel industry (and we believe likewise in the metal industry). This opinion is based on observation and reports from officials of the Steel Corporation in plants throughout the country. In spite of numerous violations of the law, it has resulted in a decrease in the consumption of alcoholic liquor, a decrease in crime and poverty, and an increase in the health of workers, their families and their savings deposits. The conditions seem to have gone even further in that they have benefited not only the workers, but the companies by whom they were employed. Judge Gary remarked on their improved working ability and disposition. He believes that prohibition is a paying institution and declares that he is against any modification of the prohibition laws.

CATASTROPHE IN JAPAN

The sympathy of the whole world is extended to Japan in her trials. It is our hope and belief that, with her customary energy and pluck, she will recover quickly.

As we go to press, pictures have appeared in the daily press, but no reports have been received about the direct effects of the earthquake on the metal industries. As soon as possible, however, information will be published.

CORRESPONDENCE and DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein

NICKEL SOLUTIONS

To the Editor of THE METAL INDUSTRY:

I have noted Mr. Joseph Haas's article on nickel solutions in the June, 1923, number of THE METAL INDUSTRY. This article is of very much interest to me because of some work which I have done along the same lines and which also was reported in an article given before the American Electro Platers' Society at Indianapolis, June 2, 1921. In that article I pointed out the practical application of the theoertical results which are given in your paper. It so happened that my work was entirely independent of that of Blum and Thompson.

The method which I worked out is very simple of application and makes use of the color changes when Methyl Red is used with a nickel-plating solution. This method has been used at the plant of the Malleable Iron Range Company at Beaver Dam, Wisconsin, successfully for three years and we are informed that the plater would not do without this method so as to keep his plating solutions correct as far as acidity and alkalinity are concerned. The method outlined on page 231 is complicated and therefore has its objections. The method which I have outlined and which is in use at the Malleable Iron Range Company is very simple. I believe it would be of a great value if the results of this work could be given to the plating industry as I think a simple method involving only the use of a dropping bottle and test tube is of much more value than a complicated method.

I will be very glad to give any further details or a copy of the paper which I gave before the Society in 1921. Our only interest in this matter lies in getting this before the practical plater and hoping that he will profit thereby. We believe that a three-year successful trial of this method which we have devised and which is based upon the principles outlined in Mr. Haas's article warrants its presentation to the plating industry.

C. F. BURGESS LABORATORIES,
Madison, Wis., July 16, 1923. Oliver W. Storey.

Mr. Oliver W. Storey,
C. F. Burgess Laboratories.

Your letter of June 16th addressed to me in care of THE METAL INDUSTRY has been forwarded to me.

Due to space conditions the editor terminated June's issue of the resume on Nickel Solutions with the abstract of Dr. Blum's and Mr. Thompson's method of control of the acidity of nickel solutions. Directly following that is an explanation of the method that had been evolved by you, which I had obtained from the Monthly Review of the American Electro-Plater's Society.*

It was and still is my plan to incorporate in the "Survey of Nickel Solutions" not only my own experiments and experience, but also to state, unbiased, the works of others, so that platers can use whatever is most practicable to them depending upon the circumstances they find themselves.

True, I have featured a more complicated method of determining the acidity of nickel solutions, but I feel justified in doing so because there is so much lack of technical practice in electro-plating. However, I have not forgotten the men, that are too advanced in years to go into the technical details of electro-plating and consequently I had not failed in writing the "Survey of Nickel Solutions" to give an account of your work.

Upon the publication of that part of the article dealing with your method of controlling the acidity of nickel solutions, should you think that I had not been explicate enough in my presentation to the electro-plating trade, I request that you, by means of a letter addressed to the Editor of The Metal Industry emphasize the weak points of my presentation.

Thanking you for the courtesy of your communication, I remain,

JOS. HAAS, JR., Asst. Supt.,
Ontario Silver Company.

Muncie, Ind., July 23, 1923.

*See The Metal Industry, July, 1923, p. 273.

GUARANTEED ELECTRO-PLATING

To the Editor of THE METAL INDUSTRY:

I have read with interest, in your August issue, the article "Guaranteed Electro-Plating," by Charles H. Proctor. In the fourth paragraph reference is made to nickel plating which should be more substantial. I heartily coincide with Mr. Proctor in his plea.

As an admirer and user of hot nickel solutions I am of the opinion that the foreman electroplater can improve a nickel plated product in the same space of time and perhaps, in some cases in less time, by heating the nickel electrolyte.

I have deposited 1½ thousands of an inch thickness of nickel in a warm nickel solution in one hour, as against 1 thousandth of an inch in a cold solution on work which would permit of a low current density only. Heating a nickel electrolyte decreases the resistance which permits a higher amperage to pass at the same given voltage, which means that more metal is being deposited.

If 50 per cent more metal can be deposited at 1.8 volts and low current density I think that at high current densities with a "High Speed" nickel solution the percentage would be staggering to us.

ROYAL F. CLARK,
Foreman Electroplater, E. Peter & Co., Irvington, N. J.
Newark, N. J., Sept. 28, 1923.

Technical Publications

CHROMIUM PLATING STEEL USING CHROMIUM ANODES

By KEVIE W. SCHWARTZ†

The various solutions suggested in the past for electrodeposition of chromium were investigated, and it was found that Sargent's solution of chromic acid and sulfate gives consistently good results. Hard, bright, adherent deposits on steel were obtained. However, no chromium plate was obtained unless hydrogen in considerable excess was simultaneously discharged at the cathode. Chromium metal anodes were used, and no passivity was observed even after many hours operation. Chromeplated steel resists the corrosive action of air saturated with ammonia fumes, nitric acid or sulfuretted hydrogen. Chromeplated steel is not attacked by molten tin, zinc or brass.

†Abstract of a paper presented at the Forty-fourth General Meeting of the American Electrochemical Society in Dayton, O., September 27-29, 1923.

THE USE OF MERCURY IN THE PURIFICATION OF ZINC SULFATE SOLUTIONS

By SAMUEL FIELD AND WM. E. HARRIS†

The need for zinc sulphate solutions of a high order of purity is first explained and the real advantages accruing thereto later indicated. The use of mercury as a purification agent is discussed in detail, this application being based on the well-known over-voltage of mercury against hydrogen. By amalgamating finely divided negative metals, such as zinc and aluminum, complete purification can be readily and economically effected even in strongly acid solutions. The mercury is added to the zinc liquors as mercuric sulphate, followed by zinc powder or zinc blue. The impurities are eliminated in preference to the hydrogen of the acid added. Economy of zinc is thus effected, and the method becomes applicable also for cases in which high acid content would prohibit purification owing to high consumption of zinc. An estimate of the costs of purification chemicals is included.

THE NATURAL WATER CORROSION OF STEEL IN CONTACT WITH COPPER*

W. G. Whitman and R. P. Russell

Experiments are described wherein the natural water corrosion of steel in contact with a metal lower in the electromotive series has been quantitatively determined. The results show that the total corrosion is the same with bare steel plates as with steel specimens of the same size having 75% of their surface copper plated; i. e., in the latter case the corrosion per unit area of steel is four times as great as in the former. The total corrosion observed is determined by the total effective surface available for the depolarization of hydrogen by dissolved oxygen, the actual corrosion occurring on the steel alone.

These results are not readily explainable by the colloidal theories of corrosion advanced by J. N. Friend or Bengough and Stuart, both of which agree that hydrogen is not an essential in natural water corrosion. The data are, however, in entire accord with an electrolytic mechanism of corrosion. The electrolytic theory explains these results by picturing the increased corrosion per unit area of steel as caused by the depolarization of a film of nascent hydrogen. This film is deposited on the steel and on the adjacent copper surface and its removal is affected by diffusion of dissolved oxygen in to the metal. The rate of corrosion is limited by the rate at which oxygen can diffuse in to react with the surface film of nascent hydrogen.

The importance of these quantitative data in deciding as to the mechanism of the corrosion of steel is emphasized from both a theoretical and practical point of view.

*Abstract of a paper presented at the Sixty-sixth General Meeting of the American Chemical Society in Milwaukee, Wis., September 10-14, 1923.

New Books

Practical Electro Plating by W. L. D. Bedell. Size 5¼ x 7½, 407 pages. Price payable in advance $3.00. For sale by The Metal Industry.

This is the fifth edition of an already well known book which has been completely revised and greatly enlarged. It is intended as a guide for the electroplater and also gives complete instructions for the arrangement of the shop, the installation of a plant for polishing, electroplating, buffing and lacquering. The language used is essentially simple and intended to be easy for the typical shop worker or plater to read. The author covers nickel, copper, brass, bronze, zinc, silver, tin, steel, cobalt, lead and gold solutions; also dips, cleaners and pickles.

A section is devoted to calculations for plant layout, such as ampere capacity of the generator, size of the plating tanks required and the ampere carrying capacity of tank rheostats. Sections are also devoted to non-electric finishes and lacquers.

Considerable miscellaneous information is included which is of value to the plater. The writer is himself a practical plater and knows the details of the work about which he writes.

Alloys Resistant to Corrosion. A general discussion held jointly by the Faraday Society and the Sheffield Section of the Institute of Metals of England, in April, 1923. It can be obtained from the Faraday Society, 10 Essex Street, Strand, W. C. 2, London, England, for 5s 6d.

This is a reprint from the discussions of the Faraday Society Volume XIX, Part 1, July, 1923, consisting of papers read and the discussions which followed. Among these papers were the following: The Corrosion of Industrial Metals, by W. H. Hatfield; Heat and Acid Resisting Alloys (Ni-Cr-Fe) by J. F. Kayser; Monel Metal by J. Arnott; Corrosion Tests on Certain Nickel Alloys by F. Orme; The Mechanism of the So-Called "Dry Corrosion" of Metals, by U. R. Evans.

Financial and Operating Ratios in Management, by James H. Bliss. Published by the Ronald Press Company. 396 pages, size 6 x 8½. Price, payable in advance, $6.00. For sale by The Metal Industry.

Here is an unusual book summarizing what are really the essentials of management problems. The author develops certain standard ratios for the use of managing executives in securing more effective control of finances and operations of their business. He shows how to lay out extensive and complete business statistics in condensed and tabulated form so as to show at a glance the progress or retrogression of an organization.

Part 1 considers the various ratios and turnovers to be noted and compared. It explains in detail the methods of computing these standards of measurement of business efficiency. Part 2 gives, with explanations, tables of ratios, turnovers and other statistics compiled from published reports of representative companies in many industries.

These statistics, although broad and general, are nevertheless valuable in that they summarize the operations of enough important concerns in their fields to serve as a guide for an executive who is operating in any of these fields. It is stated that the book is intended to be useful for business executives, which, of course, includes works managers. It should also be studied by superintendents and assistant superintendents, both to give them an idea of what their plants are doing and to prepare them for promotion.

Among the measurements covered are the following:
Relation of operating profits to total capital employed.
Relation of operating profits to volume of business.
Relation of gross earnings to volume of business.
Relation of costs and expenses to volume of business.
Turnover of inventories.
Working capital ratio.
Analyzing financial statements.
Preparation of financial statements.

The second part of the book, which is largely tabulation, gives examples of actual record of the above measurements. The book is of extraordinary value to industrial executives.

Chemical Engineering Catalog. 8th annual edition. Size 9 x 12, 1049 pages. Published by the Chemical Catalog Company. The price is $2 per year.

This catalog is a collected and standardized data of equipment, machinery, laboratory supplies, heavy and fine chemicals and raw materials used in the industries employing chemical process of manufacture. There is included a general directory of equipment and materials, and in addition an unusually strong section on technical and scientific books. The method employed is to describe the products of each company which appears in this volume and to illustrate these products. Much of the material along the lines of equipment, machinery, etc., will interest the manufacturer or user of metals.

GOVERNMENT PUBLICATIONS

Graphite in 1922, by Arthur H. Redfield, U. S. Geological Survey, Washington, D. C.

Arsenic in 1922, by V. C. Heikes and G. F. Loughlin, U. S. Geological Survey, Washington, D. C.

Fuller's Earth in 1922, by Jefferson Middleton, U. S. Geological Survey, Washington, D. C.

Graphite in 1922, by Arthur H. Redfield, U. S. Geological Survey, Washington, D. C.

Quicksilver in 1922, by F. L. Ransome, U. S. Geological Survey, Washington, D. C.

Magnesium and Its Compounds in 1922, by J. M. Hill and G. F. Loughlin, U. S. Geological Survey, Washington, D. C.

Lead and Zinc Pigments and Salts in 1922, by C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Lead in 1922 (general report), by C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Zinc in 1922, by C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Bismuth, Selenium and Tellurium in 1922, by Victor C. Heikes, U. S. Geological Survey, Washington, D. C.

Mineral Resources of the United States in 1922 (preliminary summary). Introduction by G. F. Loughlin. Statistics assembled by Martha B. Clark, U. S. Geological Survey, Washington, D. C.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

BRIGHT FINISH ON ALUMINUM

Q.—I am enclosing samples of metal on which we would like to put a bright dip finish if possible. We have tried the Aqua Fortis dip, but that leaves the surface with a matt finish. What we desire is a bright finish the same as on dipped brass.

A.—We presume the sample parts of metal submitted to us a bright dip finish are of aluminum. A bright finish as produced upon sheet brass cannot be produced upon aluminum by the usual bright acid dip or any combination of dips. Your only resort is mechanical methods; if you can, tumble the articles you produce in scrap sheepskin or kid leather and use a small amount of Vienna or carbonate of lime as the polishing medium. You can thus obtain a bright finish equal to a dip brass finish.—C. H. P. Problem 3,246.

BRONZE FINISHING

Q.—We would appreciate the favor if you would send us a list of three or four first-class manuals on the art of bronze finishing. Perhaps you may have in your files the proper instructions for obtaining a rich chocolate brown finish on small bronze statuary.

A.—Deposits of copper give the most satisfactory surface for chocolate bronze finish; that is, if it is produced chemically. This finish, however, is imitated to a great extent with lacquer enamels that are applied to metal objects by spraying.

We would suggest for this finish that the bronze statuary be copper-plated for a short time, then scratch-brushed and cleansed. Then immersed in a solution of barium sulphide at 180 degrees Fahr. After the color has been produced the articles should be carefully washed and dried, then very lightly scratch-brushed to bring out the color and then finally lacquered or waxed.

Such a solution should be prepared as follows:

Water	1 gallon 180 deg. Fahr.
Sulphide of barium (stock solution)	4 ounces

To prepare the stock solution dissolve 4 ounces of sulphide of barium in every 32 ounces of water, liquid measure at 180 degrees Fahr. Keep the receptacles air tight and use as outlined.

The following solution (exact proportions unknown) gives excellent results:

Water, 1 gallon temp. 160 to 180 deg. Fahr.
Copper sulphate, 8 ounces.
Permanganate of potassium, ½ to 1 ounce.

The proportions given may be experimented with and changes made according to the results obtained.—C. H. P. Problem 3,247.

BROWN OR BRASS

Q.—I hope you can furnish me with some process that will enable me to produce a brown color on brass, as my present method of coppering, plating, oxidizing and scratch-brushing is a a very slow process. I will appreciate it very much if you can furnish me with a chemical dip or solution that will produce a dark brown direct on brass after the article has been passed through the bright acid dip, with full directions for me to operate.

A.—The production of a brown color upon brass equal to a brown finish produced by first coating the brass with a thin deposit of copper, and coloring by the aid of polysulphide or sulphuret of potassium and finally scratch-brushing and lacquering, is more difficult, as brass does not oxidize as readily as copper or bronze.

Some platers use the ammonia copper carbonate black solution for brown tones upon brass. By adding the copper carbonate slightly in excess of the ammonia a brown instead of a black results.

If the articles are lightly scratchbrushed dry and finally lacquered a pleasing brown tone results.

However, one of the best factors is golden sulphuret of antimony dissolved in either qua ammonia or caustic potash. The solution should be used hot. Try the following proportions:

Water	1 gallon
Aqua ammonia or caustic potash	4 ozs.
Golden sulphuret of antimony	1 "

It is possible that these materials used in smaller proportions than those given will give results.

Immerse the brass articles in the solution at a temperature of 180 degrees Fahr. until they become a dark in tone. Then remove, immerse in boiling hot water for a few minutes, dry out thoroughly, and lightly scratchbrush dry and finally lacquer.

Immersing the articles in a very dilute solution of sulphuric acid, muriatic acid or copper sulphate in water, darkens the bronze tone. If the articles are immersed in the acid dip following the immersion in the antimony dip, and washing in cold water followed by the hot water.

Acid dip. Water cold	1 gallon
Sulphuric or muriatic acid	¼ to ½ ozs.
Or copper sulphate	1 oz.

After this follow up with the washing, drying, brushing and lacquering as outlined.—C. H. P. Problem 3,248.

BRAZING STEEL TUBES

Q.—He wants to know the proper composition of brazing solder for brazing tubular steel skates and also for brazing long tapered steel tubes. What temperatures should this brazing mixture be used at and where can it be obtained? What is the exact composition of the mixtures?

A.—Before brazing steel, the surface be thoroughly cleaned either by filing, grinding or by the process of a sand blast. The alloys or spelters used for brazing are composed of copper zinc alloys. The melting point of these alloys depend upon the percentage of zinc. The fusing point of the spelter should be as close as possible to that of the article to be brazed as a more tenacious joint is thereby secured. An easily fusible spelter may be made of two parts zinc and one part copper, but the joint will be weaker than when an alloy more difficult to fuse is used. A spelter that is readily fused may be made of 44 per cent copper, 50 per cent zinc, 4 per cent tin and two per cent lead.

Alloys containing much lead should be avoided, since lead does not transfuse with brass and thus decreases the strength of the joint. Use borax as a flux. See advertising pages of THE METAL INDUSTRY where brazing metals can be obtained.—P. W. B. Problem 3,249.

BALL BURNISHING

Q.—We have a problem in one of our departments of polishing and drying metal parts after burnishing and are writing you to ask your opinion or suggestion as to the best kind of material to use for this kind of work. We are particularly interested in a material to polish and dry pencil clips such as we are enclosing herewith. At the present time, we are using sawdust.

A.—It would seem to us that your proposition of polishing pencil clips and other similar materials could be best worked out by ball burnishing. Plenty of balls about ⅛ inch in diameter should be used. The lubricant should be neutral soap chips, dissolved in water in the proportion of one-half ounce per gallon. Whale oil soap in the same proportions also gives excellent results.

If a polish is required to resemble "buffing," the clips should be dry tumbled after ball tumbling, by the aid of sole leather clippings or scrap kid or similar leather. A small amount of Vienna lime should be used as the polishing medium.

For drying out your class of product a centrifugal dry will give the best results, especially if hot is used in connection with the dryer. Articles can thus be dried directly after leaving the rinsing water.—C. H. P. Problem 3,250.

FLUX FOR ALUMINUM-ZINC ALLOY

Q.—Would be glad to have whatever information you might have in regard to the best flux in connection with zinc and aluminum combination. We have always used chloride of zinc for aluminum, but it seems that another agency would probably be better in connection with the combining of zinc and aluminum.

A.—In connection with zinc and aluminum mixture, sal ammoniac and chloride of zinc is the flux used by most people. A very good flux that gives excellent results is sal ammoniac skimmings from galvanizing pots. It is cheap and contains the chloride of zinc and sal ammoniac.—W. J. R. Problem 3,251.

METAL MIXTURES

Q.—Could you inform me of a good white metal mixture for large pattern castings. Metal must be very tough so it can be bent into different shapes? What is a bronze mixture for architectural and statuary castings?

A.—A very good mixture for pattern work, one that will give the minimum shrinkage, and will bend if properly alloyed, consists of 58% tin; 42% high grade zinc.

Melt the tin; add the zinc a little at a time and stir well. Pour at a temperature that will not burn a pine stick.

For architectural and statuary tablets, ornamental work, the following mixture is best:

Copper	90%
Tin	7%
Zinc	2%
Lead	1%

New metal should be used to obtain the best results.—W. J. R. Problem 3,252.

NON-MAGNETIC BRONZE

Q.—Please give us some information on non-magnetic bronze.

A.—From the investigations of Tammann (Z. f. Phys. Chem. 1909, vol. 65, p. 73) and confirmed by the later work of Honda (Ann. d. Phys. 1910 (4), Vol. 32, p. 1005), it follows that while manganese itself is non-magnetic, yet in combination with certain proportions of other metals such as copper, aluminum, arsenic, antimony, bismuth and boron, it forms alloys that are magnetizable under certain temperatures and concentrations.

It also follows from their investigations that any manganese bronze, composed of copper, zinc, a small portion of manganese and of iron, and of lead, can lose all of its magnetizability by simply heating the bronze above the highest transformation point of any of its constituents. For instance, the transformation point of iron is at about 780 Deg. C. Nickel lowers this point some 20 or more degrees. Nickel has a transformation point at 350 deg. C., which is increased five degrees by the addition of 4% of lead. The transformation of nickel and manganese itself is at a very low point, far below what would be met with in commercial use except for refrigerating purposes. At a very low temperature, that is to say in liquid air, it is unmagnetic. At some temperature between zero and that of liquid air, it passes over into a magnetic modification. Zinc has a transformation point at about 360 deg. C. Tin has two, one at 170 deg. C. and the other at 18 deg. C. or 64.4 Fahr. The latter point occurs when the metal is cooled at room temperature. Tin is the most dangerous constituent to look out for in manganese bronze, on account of its low transformation point.

But it is known that if manganese bronze, containing a small amount of iron, as it should, be heated above 780 deg. C., and then suddenly cooled at room temperature, or possibly at zero degrees C., it will lose its magnetism permanently, provided that it be not heated again to 110 deg. C. (230 deg. Fahr.).

In making non-magnetic manganese bronze, it would be an important precaution to take to avoid using any aluminum in the making of the alloy, not using it even as a flux, nor allow it to creep in as an impurity; also to keep the tin as low as possible, and to increase the lead from 0.5 to 2%, if such increase will not lower the tensile strength and elongation of the alloy too much for the intended purpose. Also avoid using any antimony or arsenic so as to keep away from the formation of any of the Heusler compounds, even to a slight degree, as they would be carriers of magnetism, and difficult to get rid of.—R. E. S. Problem 3,253.

PLASTER MOLDS FOR ALUMINUM

Q.—We would very much appreciate it if you could give us information in regard to casting aluminum alloys in plaster paris molds.

A.—Plaster molds for casting aluminum are made up of a mixture of plaster paris and lime; about 10% lime. The patterns are mounted on a plate. The plate is attached to some kind of a drawing device, similar to the drawing devices used in molding machines where the patterns can be lifted from the mold very true.

The plaster and lime are mixed and poured over the pattern, making the thickness of the mold, so there remains about one-half an inch plaster over the patterns. The patterns are cast so the plaster will not stick; just as the plaster is setting the patterns are removed from the mold and left to stand a short time, then transferred to a special oven. One that takes out the moisture very rapidly, and dry in a temperature of approximately 400° F. from 6 to 7 hours, or until all the moisture is removed. The molds are then removed from the oven, clamped, weighted down and poured. If handled properly, very nice castings are obtained, equal to any die casting. The plaster is ground up and about 40% of it is used for casting again.—W. J. R. Problem 3,254.

POLISHING ALUMINUM

Q.—We are interested in polishing aluminum castings. We desire to finish the same to a mirror polish equal to fine nickel plating work. We are communicating with a number of your advertisers of buffing and polishing equipment, mentioning your paper, but presume they will simply furnish with grade of wheels and names of compounds to be used. We would esteem it a favor if you would explain clearly the exact procedure, grades of wheels and compounds such as emery tripoli or the like to be used from roughing to a lustre finish. Our foreman has had experience in polishing steel and fine tool work, but has never attempted aluminum.

A.—If the methods and manipulations used in polishing and buffing fine brass castings are adhered to in polishing aluminum, similar results will be obtained.

Kerosene oil is a splendid factor in polishing aluminum. A very little applied to the buffing wheels will prevent glazing of the wheels which is frequently the cause of scratches and dullish lustre.

Briefly mentioned the operations should be as follows:

1st. Polish by the use of solid felt or canvas wheels coated with 100 emery. The emery should be applied in the usual manner by coating the wheels with polisher's glue and then rolling them in emery. If the emery appears too coarse, fine down with a flint stone and apply a little tripoli to the wheel.

2nd. Polish down with a tampico wheel, using emery paste, about 180 to 200 fine.

3rd. Cut down with tripoli composition, using unbleached muslin buffs at 2,500 revolutions per minute for a 12-inch wheel. Use a little kerosene as noted.

4th. Color with a coloring buff, 6 to 8 inches in diameter, at 3,500 revolutions per minute, using the finest grade of white lime composition. A very little kerosene will be advisable as noted.

5th. Finish by the aid of canton flannel wheels, 6 to 8 inches in diameter, run at 800 to 1,000 revolutions per minute.

The final polishing medium should be jewelers' fine gold rouge powder mixed with denatured alcohol. Apply to the wheel with a brush. This operation is termed a wiping operation, and results in a high lustre upon the aluminum.—C. H. P. Problem 3,255.

ZINC POISONING

Q.—What is a good remedy for zinc poisoning?

A.—So-called poisoning by zinc fumes produces cramps in the limbs, trembling, coughing, stomach trouble and blindness at night. Good ventilation and proper precautions will prevent this.

When troubled with the "spelter shakes," as it is most commonly called, hot milk is one of the best remedies. Milk is very good to drink when working around zinc fumes, also eggs. We have found that if hot milk is taken just before retiring it will relieve the most violent cases. While this trouble is very annoying, it never becomes serious, and milk is the best antidote.—W. J. R. Problem 3,256.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,460,317. June 26, 1923. **Coating Composition.** Annual Duke, Marion, Ind.

A composition for use upon metallic surfaces for the protection thereof from the elements of erosion consisting of lard oil, lubricating oil and white lead of equal portions mixed with a lesser portion of graphite and powdered borax and lamp black of equal portions but of less portion than the graphite.

1,460,830. July 3, 1923. **Metallurgical Process.** Herman G. C. Thofehrn, Roselle Park, N. J.; Donald H. McLean administrator of said Herman G. C. Thofehrn, deceased.

A metal scavenging process consisting in introducing in the molten metal to be treated, during the pouring of the molten metal into the ladle, an alloy of aluminum and magnesium in the proportions to said molten metal substantially as specified.

1,460,888. July 3, 1923. **Method of Continuously Melting Vitreous Enamels.** Frederick D. Cook, Fairmont, W. Va.

The herein described method of forming vitreous enamels which consists in utilizing a melting chamber formed to prevent collection of melted enamel in a pool and permit the enamel to run continuously from the chamber as it melts, in continuously withdrawing and quenching the melted enamel and in controlling the temperature of the enamel during its withdrawal and prior to quenching.

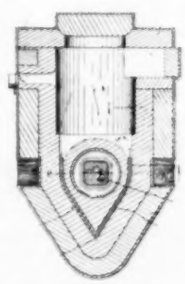
1,461,178. July 10, 1923. **Alloy.** Hugh S. Cooper, Cleveland, Ohio, assignor by mesne assignments to Kemet Laboratories Company, Inc., a Corporation of New York.

An alloy composed of a preponderating amount of nickel, aluminum and silicon in which the percentage of either of the last two substances is not less than three per cent and not more than twelve per cent.

1,461,643. July 10, 1923. **Alloy.** Frederick M. Becket, Niagara Falls, N. Y., assignor to Electrometallurgical Company, Niagara Falls, N. Y.

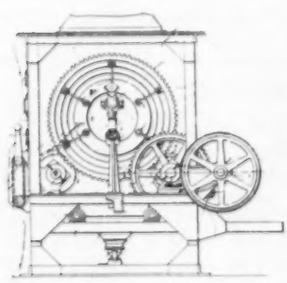
An alloy containing as essential components magnesium, silicon and manganese, the silicon in excess of the equimolecular proportion to the magnesium, and the manganese in lesser molecular proportion than the silicon.

1,461,862. July 17, 1923. **Manufacture of Electric Furnace Linings.** Walter R. Clark, Bridgeport, Conn., assignor to Bridgeport Brass Company, Bridgeport, Conn.



The method of starting an induction furnace, which consists in placing within the heating space of said furnace a composite body formed of materials of different melting points, then melting the material of lower melting point and then melting the material of higher melting point.

1,462,295. July 17, 1923. **Sand-Blast Apparatus.** Edward J. Moore and Raymond H. Moore, Cleveland, Ohio, assignors to the W. W. Sly Manufacturing Company, Cleveland, Ohio.



The combination, with a barrel of an arm pivoted adjacent to said barrel, an extension of said arm rotatably and longitudinally adjustable with respect thereto, a clamp pivotally connected to such extension, a sand blast gun supported by said clamp, and connections for supplying sand to said gun.

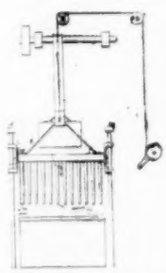
1,461,863. July 17, 1923. **Manufacture of Electric Furnace Linings.** Walter R. Clark, Bridgeport, Conn., assignor to Bridgeport Brass Company, Bridgeport, Conn.

The method of making the refractory structure of an electric furnace or the like having a passage or channel, which comprises tamping refractory material about a templet of the same shape as the passage to be formed and consisting of a metallic outer part temporarily reinforced with a filling so that such templet is sufficiently hard and strong to resist collapse under tamping pressure, and then eliminating the filling material.

1,462,296. July 17, 1923. **Sand-Blast Apparatus.** Edward J. Moore and Raymond H. Moore, Cleveland, Ohio, assignors to the W. W. Sly Manufacturing Company, Cleveland, Ohio.

The combination with a head having an upper passageway and a lower passageway with a partition between said passageways and a passageway communicating with the upper passageway between the front and the rear thereof and above said partition, of a tapered baffle extending downwardly within the upper passageway and located rearwardly of the third passageway, a pressure-fluid pipe communicating with the rear of the upper passageway, a pressure-fluid pipe communicating with the rear of the lower passageway, and a nozzle common to both passageways.

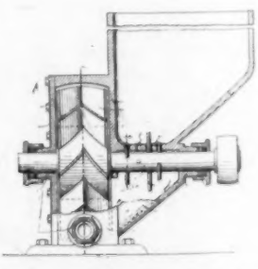
1,462,608. July 24, 1923. **Method of and Apparatus for Enameling Tubes.** Norman Marshall, Waltham, Mass.



The method of dip enameling the exterior of tubes which consists in closing the upper end of a tube, dipping it vertically in a bath of enamel, and subsequently removing it at a slow and uniform rate. An apparatus for dip enameling tubes having, in combination, means for closing the upper ends of the tubes, an enameling tank, means for dipping the tubes vertically in the tank, and means for withdrawing the tubes at a slow and uniform rate of speed.

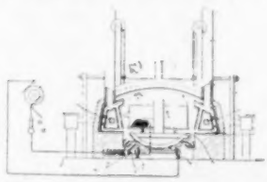
An apparatus for dip enameling tubes having, in combination, tube supporting means, means for moving the tube supporting means vertically to dip the tubes into a bath of enamel, and means for withdrawing the tubes vertically from the bath of enamel.

1,462,786. July 24, 1923. **Sand-Blast Machine.** David P. Cleveland, Dallas, Tex., assignor of one-half to J. A. Bergfeld, Dallas, Tex.



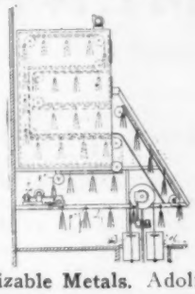
In a sand blast machine, a hopper, a turbine, a housing enclosing the turbine, said housing having means for admitting a fluid under pressure for driving said turbine, means cooperating with said turbine for agitating the sand in the hopper and causing the same to precipitate into said housing, and means for discharging said fluid and sand from said housing.

1,462,899. July 24, 1923. **Furnace for Melting and Casting.** George Hillard Benjamin, New York, assignor to Anatmos Metals & Furnace Corporation, New York.



In a structure of the class described, the combination of a tunnel kiln, means for heating the interior of the kiln, a series of melting furnaces, means for leading the melting furnaces, said means being independent of the means for heating the interior of the kiln, and means for moving the melting furnaces through the kiln.

1,463,313. July 31, 1923. **Japanning Apparatus.** David F. Domizi, Cleveland, Ohio.



In an apparatus for japanning articles, a conveyor for the articles to be japanned, means for immersing the articles in a japanning solution comprising a pair of vertically movable receptacles beneath a portion of the conveyor, and means for raising and lowering said receptacles, said receptacles being connected so as to be simultaneously moved in opposite directions.

1,463,609. July 31, 1923. **Casting Oxidizable Metals.** Adolf Beck and Karl Gersbach, Bitterfeld, and Oskar Hermann Weber, Griesheim-on-the-Main, Germany, assignors to the firm: Chemische Fabrik Griesheim-Elektron, Frankfort-on-the-Main, Germany.

The method of casting magnesium and alloys containing same, consisting in dusting the mold, prior to casting the metal, with a material capable of giving off, in contact with the molten metal, a gaseous substance, which is more easily oxidizable than magnesium.

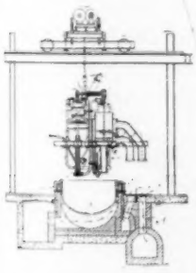
1,464,149. August 7, 1923. **Process for the Production of Glossy-Metal Coating on Metals.** Alexander Classen, Aachen, Germany.

A process for the production of glossy metal coatings on metals galvanically consisting in adding to the electrolytic bath colloids and substances easily reducible in the presence of said colloids so as to prevent the generation of hydrogen at the cathodes and conducting the galvanizing with this bath in the usual manner.

1,464,506. August 14, 1923. **Electrolytic Process.** James S. Groff, Newport, R. I.

The method of lining a torpedo flask or the like, consisting in gradually electrolytically depositing on it as a cathode a thin dense leaden coating internally thereof from an electrolyte from a lead salt of hydrofluosilicic acid contained within the flask.

1,465,128. August 14, 1923. **Apparatus for Refining Metals.** Henry Harris, London, England.



Apparatus for refining molten metal by passing it through a molten reagent, comprising a melting pot for the metal, a framework adapted to be lowered to rest on the melting pot, a container for the molten reagent carried by the framework, means carried by the framework and immersed in the molten metal for raising the latter and delivering it into the container, and a passage between the bottom of the container and the melting pot.

1,465,173. August 14, 1923. **Method of Electrodepositing Cobalt and Chromium.** Harry Creighton Peffer and Harrie Clark Pierce, La Fayette, Ind., assignors to James Clarence Patten, Kokomo, Ind.

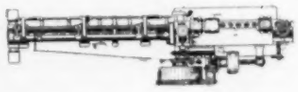
The method of obtaining deposits of cobalt chromium alloy resistant to the action of practically all atmospheric conditions and practically immune to the action of all organic and mineral acids, which consists in passing an electric current through a bath containing chromium and cobalt compounds, the temperature of the bath and the current density being so controlled as to produce a hard adherent deposit of cobalt and chromium.

1,465,553. August 21, 1923. **Solder-Filled Wire and Method of Manufacturing Same.** Lloyd H. Kirk, Providence, R. I., assignor to Martin-Copeland Company, Providence, R. I., a trusteeship consisting of Edgar W. Martin, Barrington, R. I., Laurence C. Martin, Providence, R. I., and Geo. W. Bleecker, Chicago, Ill.

An improved solder-filled wire for use in jewelry manufacture or kindred arts comprising a hollow body of precious metal, a core of solder contained therein, and a thin sheath of impenetrable material enclosing the solder core to separate it from the precious metal to prevent it from being absorbed thereby.

1,466,002. August 28, 1923. **Wire Straightening and Cutting Machine.** Elmore F. Shuster, New Haven, Conn.

A wire straightening and cutting machine comprising a straightening arbor, a machine shaft mounted on the frame of the machine and with its axis parallel with the axis of said arbor, a flywheel shaft with its axis located at right angles to the axis of said machine shaft, cutting off mechanism connected with said flywheel shaft, feed rolls with their axes located parallel with said flywheel shaft, a connecting shaft a toothed geared connection between said machine shaft and said flywheel, and another toothed geared connection between said connecting shaft and said feed rolls.



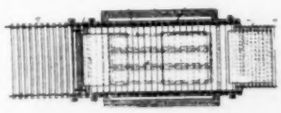
1,466,061. August 28, 1923. **Homogeneous Aluminum Solder.** Oscar Rebello, Bahia, Brazil.

A solder for aluminum composed of silver ranging from 53 to 63 parts, copper ranging from 57 to 64 parts and aluminum ranging from 64 to 73 parts.

1,466,125. August 28, 1923. **Oiler for Metal-Casting Machines.** Charles F. Faupel, Chicago, Ill.

In a machine for forming metal objects by forcing molten metal through a die, a means for introducing lubricant to the stream of molten metal to facilitate its travel through the die, comprising a vapor chamber containing oil vapor, and a pipe leading therefrom to the stream of molten metal.

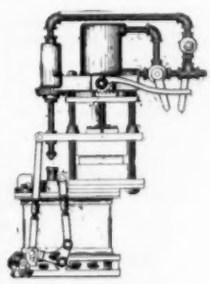
1,466,257. August 28, 1923. **Method of Annealing Metal.** Randal E. Talley, Irwin, Pa., assignor to Westinghouse Electric & Manufacturing Company, a Corporation of Pennsylvania.



A method of annealing aluminum which comprises passing the aluminum through an electrically heated furnace at a predetermined speed.

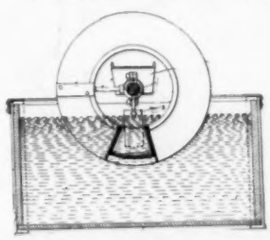
1,466,490. August 28, 1923. **Die-Casting Machine.** Oscar L. W. Swenson, Brooklyn, N. Y.

A die casting machine including a fire box and a pneumatic ram surmounting the same, said ram having a movable ram member, a ladle provided with a rearward arm pivoted upon the rear of said fire box, a rocker arm upon the same fire box, a link connecting said movable ram member with one extremity of said rocker arm, a shaft secured to said ladle, and a link connecting said ladle shaft with the other extremity of said rocker arm.



1,466,582. August 28, 1923. **Plating Machine.** William Dietzel, Merrick, N. Y.

A plating machine comprising a solution carrying vat, a spiral article carrying member substantially U-shaped in cross section, rotatable means for operating said article carrying member so that the same will transport said articles through said solution from adjacent one end of the vat to adjacent the opposite end, means for enriching the solution in a line adjacent the path traveled by said articles, and means for causing an electrical current to pass through said articles as the articles travel.



1,467,060. September 4, 1923. **Anode.** August P. Munning, Brooklyn, N. Y., assignor to A. P. Munning & Company, New York, N. Y.

An anode for electrolytic apparatus comprising a metallic member having a ridge on its periphery directed oblique to its longitudinal axis.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

New Reverberatory Furnace

The British Reverberatory Furnaces, Ltd., of 82 Victoria street, London, S. W. 1, have made an installation at the Newark, England, works of the pump-makers, Worthington-Simpson, Ltd.

The principle of design and operation of this furnace, which is fully covered by world patents, may be followed up by reference to the illustration.

The outstanding features of design of the furnace are the combustion chamber—which is separated from the working bed by a firebridge; the uptake—which also forms the metal-feeding hopper; and the vaulted roof with its particular features of design and construction, especially above the firebridge and at the "choke" point formed between the hopper and the working chamber.

Coke is charged to the combustion chamber through a charge hole in the roof of the chamber, and whilst this arrangement is fully convenient for hand-charging, we noted that it would lend itself readily to semi-automatic charging, by enabling the fuel, when required, to slide by gravity down a suitable chute from the furnace coke bunker.

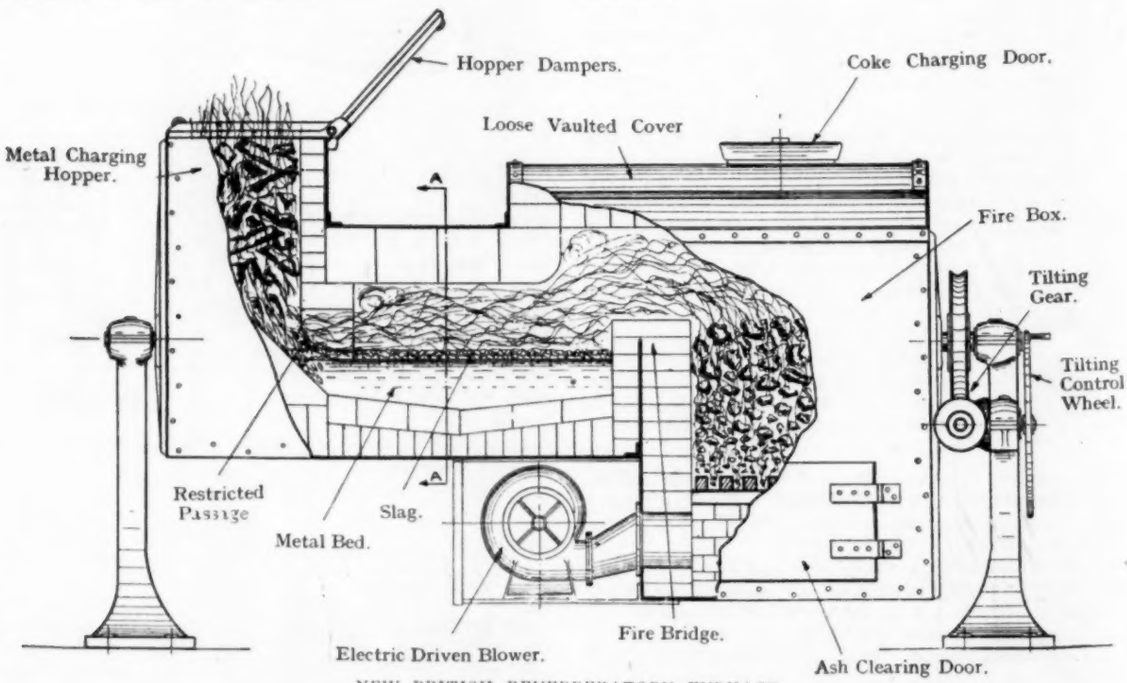
An air-blast is supplied underneath the fire-bars by a small motor-driven fan, delivering at a pressure of about 3 ins. to 6 ins. water gauge, depending on the metal being melted. The air-blast not only enables rapid melting conditions to be obtained, but it also ensures a greater economy of fuel by more perfect combustion, and also, what is equally important, it allows ready control of the furnace temperature and a flexibility of operation not always associated with solid fuel furnaces.

layer formed, and at the same time the still unmelted metal descends in the hopper towards the melting zone. Thus, although on first appearance this furnace seems much about the same as the ordinary air or reverberatory furnace, closer examination reveals a striking similarity in operation to the cupola or blast furnace; the metal hopper and uptake corresponding to the cupola stack—*i.e.*, the portion between the tuyeres and charging door; the "choke" point or restricted area corresponding to the tuyeres—thus determining the melting zone in each case; and the working bed corresponding to the cupola well or receiver.

The furnace is made in various sizes, from 500 pound capacity upwards, and although no tilting device is necessary—since in the non-tilting furnace the slope of the bed from back to front and from the two sides to the center enables the furnace to be readily tapped—it has been found that where only a few pounds of metal are drawn off at a time, a tilting device may be an advantage, especially as many non-ferrous foundrymen have a slight preference for a tilting furnace, owing to the necessary usage of a tilting device with many other furnaces.

The compactness of the furnace may the more readily be appreciated when it is mentioned that the smaller sizes, either tilting or non-tilting, may be obtained on a wheeled base, thus allowing the furnace to be moved about, and making it possible to pour direct into the molds.

The particulars of heats at the Worthington-Simpson plant are as follows:



NEW BRITISH REVERBERATORY FURNACE

As has already been noted, the exit flue or uptake also forms the metal-charging hopper, and the "choke" point or restricted passage between this and the working bed tends to retain the metal in the hopper until the metal is melted, when it drops down onto the main working bed.

It will thus be seen that, in the pre-heating of the metal up to its melting point, it is subjected to the full and direct effect of the high temperature flame, since the burning gases follow the same path, but in an opposite direction to the metal, but as soon as the metal melts it passes out of the direct zone of flame attack, or melting zone, and is further protected from oxidation by the slag

HEAT I.

11.00 a. m., approx. Furnace started. Pre-heated with 84 lbs. of coke, further 56 lbs. added later. Total, 140 lbs.
1.45 p. m. Further charge of 28 lbs. of coke and blast started.
1.50 p. m. Commence to charge metal (see mixture 1 below).
2.08 p. m. Charge of 98 lbs. of coke made.
2.20 p. m. Charging of metal finished (17 cwt. 3 qrs. 12 lbs.).
2.30 p. m. Alloy additions (spelter, tin, etc.) made.
2.40 p. m. Metal ready to tap. (After 55 minutes from start of blast).

HEAT II.

3.15 p. m. Charge coke 84 lbs. Blast started.
3.18 p. m. Commence to charge metal (see mixture 2 below).
3.36 p. m. Charging metal finished (11 cwt. 3 qrs. 18 lbs.) and charge of 70 lbs. coke made.
3.50 p. m. Alloy additions.
4.00 p. m. Metal ready to tap (after 45 minutes from start of blast).

Fuel consumption from above, over complete run (including starting furnace from cold) 424 lbs. of coke for 3,620 lbs. of metal—1 lb. of coke to 8½ lbs. of metal.

The power for blast, when melting, 1¼ to 1 h.p. Blast off when charging coke, making alloy additions, or tapping; very gentle blast only between taps and heats.

MIXTURE 1.

Scrap copper	5 cwt. 1 qr. 12 lbs.
Graded gun-metal scrap	12 cwt. 2 qrs. 0 lbs.
Alloy additions, *i.e.*, total virgin tin, spelter and lead	1 cwt. 3 qrs. 12 lbs.
	19 cwt. 2 qrs. 24 lbs.

MIXTURE 2.

Scrap copper	3 cwt. 3 qrs. 0 lbs.
Graded gun-metal scrap	8 cwt. 0 qrs. 18 lbs.
Alloy additions, *i.e.*, total virgin tin, spelter and lead	0 cwt. 2 qrs. 22 lbs.
	12 cwt. 2 qrs. 12 lbs.

The graded gun-metal scrap in mixtures above consisted of gun-metal borings, runners and other scrap mixed according to required composition of melts. The chemical analyses of samples taken from each melt were:

	No. 1 Mixture cast 2.40 p. m.	No. 2 Mixture cast 4.10 p. m.
Copper	79.54	85.41
Tin	6.72	8.08
Lead	5.47	3.48
Iron	.14	.12
Zinc	7.80	2.48

The furnace is said to give excellent results when bringing down borings alone, and in melting copper, the poling is done through the inspection hole.

Die-Casting Slush Castings

Written for The Metal Industry by R. E. BYRD, Erie, Pa.*

From the great number of inquiries received from individuals and companies who are pouring castings with metal molds and a ladle it appears that there is a great need for a more efficient method of producing such castings as casket hardware, packing rings, statuettes, toys, desk pieces, lamps, sinkers, small machine parts of a great variety, battery parts, radio parts and others too numerous to mention.

A great majority are hand poured, very hot metal and dies being used so that the mold will fill up. The metal fills the mold cavity by gravity. Sometimes it does not fill the mold, and in most cases, the mold and metal being so extremely hot, it leaves great fins on the castings which require more time to trim off than the die-casting method would take to make several castings almost free from fins and trimming. Often hot dies and metal cause the molds to crack. Moreover, it is very unpleasant for workmen to have to work with so much heat.

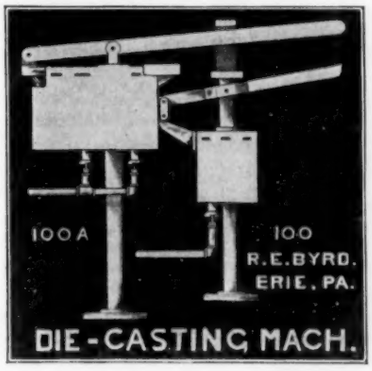
The writer has patents dated August 28, 1923, for automatic die-casting machines which have permanent dies, water cooled, which swing open and closed, and automatically produce castings and eject them from the mold into a shute which carries the castings to a box. The machine makes 1,500 operations per hour or 1,500 castings per hour where only one in a mold is cast. The machine is provided with safety arrangements so that if a casting does not eject properly it corrects itself on the next operation and continues to operate. The operator can go away from the machine indefinitely and the safety arrangements take care of the operations as long as the machine pot has enough metal in it. Both slush (hollow) castings and solid cored castings are made with this new automatic machine.

What may interest some readers in particular is a hand operated machine which makes the same castings, only the operations are performed by hand.

Pieces which are hollow and cored like casket handle tips have a special vacuum release mechanism which operates automatically by the up and down travel of the operating lever. This releases a valve so that when the surplus metal is withdrawn from the mould cavity to make it hollow the inrush of air or release prevents the vacuum effect in the die cavity which would otherwise draw the walls of the castings away also and make a defective casting every time. This can be easily understood when we know that a full can of thick oil or liquid having a small opening, turned up-side-down will not allow the liquid to escape freely unless we make a vent hole in the can somewhere, so the air can enter the can.

The hand operated machine has various ways of making castings, simple inexpensive ways, and more expensive methods of attaching the dies. All depends on the amount one wishes to put into the molds and mold bolsters and how much production is required.

The principle of machine No. 100A is that the mold is placed over an opening on the top of the machine through which the metal is forced with a plunger and lever directly into the die cavity which in many cases is water-cooled either by drilling holes or casting a water space around the mold cavity. One-eighth inch gas pipes are inserted with thick air hose attached for the water circulation.



HAND OPERATED DIE CASTING MACHINE

Water cooling a mold for fast operation gives uniform heat to the mold and allows for fast production without the overheating of the molds. It also cools the casting which naturally shrinks away from the walls and is therefore more easily ejected by the ejecter pins.

While this machine is not suitable for all die-castings it will cover a large field and greatly increase both the quality and speed for a great many who are now using the old hand-pouring method. It also casts many pieces with inserts such as glass, wood, steel, brass, etc., which must form part of the casting. The insert is placed in the mold and the molten metal cast around it or part of it as the circumstances may demand.

*Proprietor, R. E. Byrd, 318 Reed street, Erie, Pa., manufacturers of die casting machines and die-cast toys.

NEW HARDNESS TESTER

The Herbert Pendulum Hardness Tester is made by Edward G. Herbert, Ltd., of Manchester, England. It is an instrument for testing the hardness of anything from lead to sapphire. It consists of a ball 1 millimetre in diameter held at the center of the instrument and six screwed weights whereby the center of gravity of the instrument and the ball can be made to coincide. Above the ball (made of either ruby or steel) is a graduated cylindrical weight, mounted on a screw, which can be raised or lowered to the desired distance above or below the ball. If the tester is tilted and released it will swing as a pendulum. A bubble on a scale measures the distance of the swing, showing the hardness by the "scale test." The time taken to make ten swings is the "time hardness number."

NEW LINE OF INDUSTRIAL TRUCKS

The Yale & Towne Manufacturing Company of Stamford, Conn., has put out a new line of industrial trucks for various buyers. This line consists of six models, K-20 for general requirements, with a narrow, high platform; K-21, wide, high platform for use like K-20; K-22 for self-loading, high and low lifting; K-23 for general utility with a low platform; K-24, a three-wheel tractor truck; C-6-36, a flat platform trailer. Type S, a swinging boom crane can be applied to K-20, K-21 and K-23 trucks. Gravity dump bodies can be supplied as auxiliary equipment.

GENERAL UTILITY TRUCK

This truck (K-20) handles miscellaneous units of material which can be placed on the platform by hand, by chain block, electric hoist, ship's tackle or overhead crane service. Auxiliary equipment designed for it includes a gravity dump body

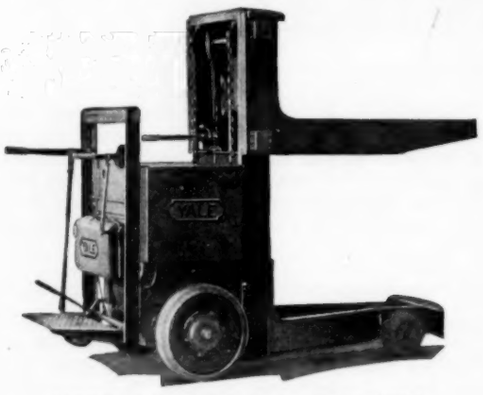
MODEL K-20 FOR GENERAL REQUIREMENTS

for handling loose material and an electrically operated swinging boom crane.

Large wheels and full spring suspension permit efficient operation over rough surfaces, while ease of control reduces handling costs in narrow aisles and congested spaces.

ELEVATING PLATFORM TRUCK

This model (K-22) is a self-loading transportation unit, combining the advantages of high and low lifting. The truck is used to lift loaded skids from the floor, transport them to a given place and raise them to such a height that the cost of stacking or tiering in storeroom, freight car, steamship hold,



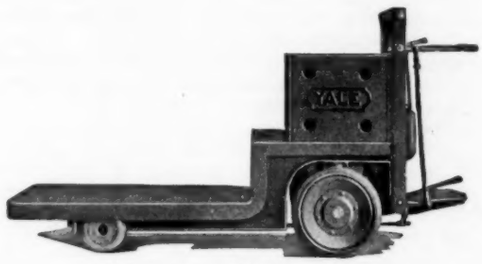
MODEL K-22. ELEVATING PLATFORM

etc., is reduced to a minimum. The time taken to load and unload this truck as compared with that required by other types of trucks, is practically nothing. Its low center of gravity and pressed steel, one-piece main longitudinal frame members admit of its carrying a 4000 pound load with safety.

LOW PLATFORM TRUCK

This is a general utility truck (K-23) which finds its application in plants and shops where loads of a miscellaneous character must be economically moved. The low platform reduces lifting to a minimum, thus making it easier to pile heavy loads on the truck either by hand or auxiliary crane equipment.

The truck is excellent where the road surface is in average



MODEL K-23. LOW PLATFORM

good condition. It has been shown many times that where the traffic is heavy enough, the laying of concrete runways will pay for itself in a short time from the gain made by improved truck efficiency combined with increased loading and unloading efficiencies obtained by the use of this type of truck. It may be stated as an axiom that good runways always pay for themselves in decreasing hauling costs.

THREE-WHEEL TRACTOR TRUCK

This model (K-24) meets the requirements of the average three-wheel tractor job, and is particularly efficient as a small load-carrying truck for service in the most congested spaces. Its platform area of 15 square feet is 70 per cent of that of

MODEL K-24. THREE-WHEEL TRACTOR

the Model K-20 load-carrying truck, yet the machine passes a three-foot doorway, or a seven-foot elevator. Due to the low center of gravity of this machine, the common occurrences of "bucking" or overturning against stalling loads, or tipping over-sidewise while rounding a corner, are eliminated.

PANGBORN EXHIBIT

The Pangborn Corporation of Hagerstown, Md., was located in spaces 74-75-83-84, occupying 800 square feet of floor space at the International Steel Exposition in Pittsburgh, Pa., October 8-12, 1923. Equipment included barrel sand-blast, cabinet sand-blast and rotary table sand-blast, all of which was in operation demonstrating the sand-blasting of heat treated parts, forging, etc.

In addition they had a display of photographs illustrating sand-blast installations in heat treating plants, interesting specimens of the heat treating art, and complete display of metallic abrasives—angular steel grit and samson steel shot, with data and information in regard to their uses. John C. Pangborn, vice-president, F. E. Wolf, district sales engineer, and H. D. Gates, sales manager, were in attendance.

GRINDING AND POLISHING MACHINE TEST

A test was made at the Excelsior Tool & Machine Company, East St. Louis, Ill., on the Excelsior No. 27 Automatic Grinding and Polishing Machine and witnessed by the undersigned for the purpose of establishing a fair cost of polishing stove tops and manifold gas pipe.

No special preparations were made for this occasion. A stock polishing machine and regular stove tops and common rough gas pipe were used; stove top cast iron, size 25" x 37" to 40" long, or 7 square surface feet, consisting of six 8" covers and loose sectional anchor plates and shelving, not sand blasted or pickled; threaded rough gas pipe ¾" x 2 foot lengths.

Stove top was ground and polished with 4 different wheels to a high commercial finish in 19 minutes and 38 seconds, which equals 24 stove tops or 168 square surface feet in 8 hours.

Gas pipe or manifolds were ground and polished with 4 different wheels ready for nickeling at the rate of 10 pipe in 17 minutes and 28 seconds, which is equal to 34 2-foot lengths of pipe in one hour or 544 lineal feet in 8 hours; buffing nickel-plated pipe at the rate of 400 lineal feet per hour.

Changing of wheels and tops was included in the above time, but does not include any time for gluing up, balancing or truing up the wheels or changing of machine.

Test made and witnessed by 35 representatives of the 21 firms which have a combined commercial financial rating of $10,000,000.

JAMES H. RHODES & COMPANY PLANT

James H. Rhodes & Company, formerly of 115 Fulton street, New York, have for years operated under a considerable disadvantage due to the fact that their Pumice Mill was in Brooklyn with a single track over which was moved over 1,800 tons of freight each month.

The Degnon Terminal in Long Island City with its wonderful advantages for handling bulky and heavy freight, gives them an opportunity of having a combined office, warehouse and pumice mill.

The dreams and plans of several years making have borne fruit in their purchasing a site of the Degnon Terminal Company. On it they are erecting what is claimed to be the last word in Pumice Mill construction, with a capacity of 800 tons a month.

In the first place the site is right on the canal, enabling them to unload the lighters of pumice direct into bins. The building itself which is now nearing completion is of reinforced concrete. A concrete bin four stories high, sufficient to hold 60 days' supply of pumice for the whole United States, is being constructed.

The pumice mill itself will contain the most improved machinery for the grinding and bolting of pumice. The warehouse facilities also will be greatly increased. Where cartage to New York is necessary their closeness to the new Queensboro Bridge will enable them to serve New York with great promptness. The old office at 115 is now vacated, and the offices, felt and sponge stocks are in the new combined office, warehouse and mill.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

BRASS MANUFACTURERS

Hea'quarters, City Hall Square Building, Chicago, Ill.

The National Association of Brass Manufacturers' held a well-attended, enthusiastic and interesting Fall Meeting in the Old Colony Club, Hotel Cleveland, Ohio, on Tuesday, Wednesday and Thursday, September 11th, 12th and 13th.

The newly established Credit Department on report of Commissioner Webster showed some very splendid results, which tends to encourage not only every member of the organization to become a loyal supporter of that particular department, but it would seem that the advantages and savings from losses in doing business should be sufficient to attract non-members to the Association, if only for the benefits of this Department alone.

The Standardization Committee tendered a most interesting report, also from the Committee on Standard Gauges for uniform sizes, tapers and threads of all basin and bath faucets. The Die Committee have rechecked the models made by the Greenfield Tap & Die Corporation and substantially all members of the Association promptly placed their order for a set of these gauges, which will not only provide a uniform and interchangeable system of threads for plumbing fixtures so that the goods made by a member in the far East will interchange with those made by a member in any other section of the Country, but the saving was marked in what these gauges might be provided for. This will be another advantage that the jobbers will have in procuring their goods from members of the Association, as so much trouble and annoyance as well as extra expense has been put upon the public in the past, by reason of the fact that the uniform cost system now adopted by the Association has never been in force or effect before.

The Committee on Elimination tendered its report, as well as the Catalog Committee. Work is progressing on the new Official Catalog, which will be issued on the first of January, 1925, which will contain goods that advancement, change, and popular use has brought into effect.

The following resolution extending co-operation to the Middle West Foreign Trade Committee was passed:

"Recommended that this Association endorse the action of the Middle West Foreign Trade Committee in regard to their Merchant Marine program and recommends that each member of this Association write to their U. S. Senators and Congressmen, asking that they support a proper bill calling for private ownership and operation of American Ships, same to be fostered and encouraged by the U. S. Government."

A Committee of three (3) was appointed to co-operate with the National Trade Extension Bureau on the question of Standardization of Catalogs, more particularly to assist this Committee than anything else, as this Association has adopted a standard uniform size of 7½ x 10⅝", this Committee was instructed to encourage no change, which is so near to that suggested by the National Trade Extension Bureau, unless some very amrked and practical reasons can be offered by the Committee for making the change, in which case the Committee was instructed to report back. The Committee consists of President Legner, E. F. Niedecken, and Commissioner Webster.

The report made at the conclusion of the final session on General Business Conditions, showed that a number of members were making goods for stock. On an average, the members had sufficient business on their books to operate their plants for over a month. The majority reported that they were operating their plants full force and full time, some stating they were working overtime. The wage and labor question seems to be more or less of a tranquil nature, while there was more or less of an evenness of mind as to whether copper would remain stationary or go to a higher plane, according to the delegates present.

After a most successful three days' meeting, the Convention adjourned to meet next in New York City on Wednesday and Thursday, December 12th and 13th.

AMERICAN FOUNDRYMEN IN ENGLAND

A party of American foundrymen, on their way to the International Foundrymen's Congress and Exhibition, which was held in Paris from September 12th to 15th, had a very hospitable reception during their stay in England. They arrived at Southampton by the "Leviathan" on August 24th and after seeing some of the principal sights of London left on August 28th for visits to Sheffield, Manchester and Birmingham. A number of ladies were in the party. The deputation, which included two Canadian foundrymen, was made up as follows: **G. W. Knotts,** United Engineering & Foundry Company, Youngstown, Ohio; **Verne E. Minich,** president American Foundry Equipment Company, New York; **John Hill,** Hill & Griffith Company, Cincinnati; **Edward W. Campion,** Buckeye Steel Castings Company, Columbus, Ohio; **J. S. McCormick,** J. S. McCormick Company, Pittsburgh; **Q. S. Snyder,** vice-president, Pittsburgh Rolls Corporation, Pittsburgh; **G. H. Clamer,** Ajax Metal Company, Philadelphia, president American Foundrymen's Association; **Dr. Richard Moldenke,** Watchung, N. J., formerly secretary American Foundrymen's Association; **Walter Wood,** R. D. Wood & Company, Philadelphia; **Jesse L. Jones,** Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; **E. H. Gale,** Cleveland, Ohio; **Stanley G. Flagg, Jr.,** Stanley G. Flagg & Company, Philadelphia; **Henry M. Lane,** president Henry M. Lane Company, Detroit; **George H. Wadsworth,** Wadsworth Core Machine & Equipment Company, Akron, Ohio; **Arthur F. Braid,** Metal and Thermit Corporation, New York; **C. S. Gilbert,** Canada Iron Foundries (Ltd.), St. Thomas, Ontario, and **L. L. Anthes,** Anthes Foundry (Ltd.), Toronto, Canada.

Leaving London on August 28th, the party visited Sheffield where they were entertained by the Sheffield Branch of the Institute of British Foundrymen and paid visits to the Hadfield Steelworks and other large manufacturing establishments. An excursion to the Peak district and other famous spots in Derbyshire concluded the visit.

At Manchester where they arrived on September 1st, they inspected the University, the Docks and Ship Canal and other sights of the city.

During a three days' visit to Birmingham the visitors were the guests of the Birmingham Branch of the Institute of British Foundrymen. A dinner was given to them at the Queen's Hotel when Professor T. Turner presided and Mr. Gilbert Vyle (W. T. Avery, Ltd.), president of the Birmingham Chamber of Commerce proposed the toast of "Our Guests." The Lord Mayor and Sir Herbert Austin (Austin Motor Co.) also were among the speakers. A number of works in Birmingham were visited and the party had the opportunity of inspecting the house of William Murdock, the Father of the gas industry, also the workshops of James Watt. Mr. G. H. Clamer mentioned that a railway engine of Watts, now in Philadelphia, had continued at work until 1885. The visitors spent a day in Coventry under guidance of local foundrymen and concluded their stay in this part of the Midlands with an automobile tour in Shakespeare's country, the itinerary including Warwick Castle, Kenilworth and Stratford-on-Avon, among the places being Harvard House.—G.

AMERICAN ELECTRO-PLATERS' SOCIETY

Headquarters, care of F. J. Hanlon, 216 N. Jefferson Street, Chicago, Ill.

FIRST CALL FOR THE 1924—A. E. S. CONVENTION

Three months have passed and as the embers of the 1923 Providence Convention of the A. E. S. burn out, a new organization arises out of the ashes to work out the problems for the 1924 A. E. S. Convention in Milwaukee, Wis. It is the desire of the convention committees to get an early start. The general committee and most of the sub-committees have been selected, the Hotel Pfister has been chosen as official headquarters, and the date set for June 30th, July 1st, 2nd and 3rd.

The work of getting the educational papers and features has been placed in the hands of Dan Wittig and Arthur E. Kienth. From the information gathered at the Providence Convention, we have learned that the success of the convention will depend largely on the educational program and getting the finished program into the hands of the members three weeks before the opening of the Convention. While the program of the Providence Convention was sent out ten days before the Convention, many of the members did not get their program until after the Convention.

The first call for papers and education features will be sent to all of the branches, and our friends, about November 1st. The second call, about January 1st. This will give the branches and all those desiring to help the A. E. S. a good chance to get a start during the winter months, and when spring comes all of this work should be finished before the call of the open again lures our friends from their work.

As the Convention is the big feature of the year's work of the A. E. S., we beg of all of our friends to have all papers and other features of the educational program in the hands of the Committee by the 10th of May, 1924.

All communications in regard to the educational program should be sent to Dan Wittig, Chairman, 375 3rd Street, Milwaukee, Wis.

WATERBURY BRANCH

Headquarters, care of Wm. Guilfoyle, 230 Cooke Street

Wm. F. Guilfoyle has been elected secretary of the Waterbury Branch to succeed Wm. Delage.

WASTE MATERIAL DEALERS

Headquarters, Times Building, New York

PROPOSED CANCELLATION OF SCRAP METAL RATES FROM NEW ENGLAND TO C. F. A. POINTS

On Thursday, August 9th, at 11 A. M., there was a public hearing in Boston before the New England Freight Committee on the proposed cancellation of commodity rates on Scrap Brass, Bronze and Copper from New England to C. F. A. territory including the Pittsburgh and Buffalo Districts.

The reason given by the carriers when docketing this proposal was that there was little traffic, if any, moving, and the rates were unnecessary.

RATES ON BRASS CARTRIDGE CASES

The Interstate Commerce Commission has dismissed Docket No. 13,666 Chase Companies, Inc., vs. Director General 81-ICC 207 and has held that the fourth class rates assessed on brass cartridge cases and brass discs from Baltimore and Eddystone, Pa., to Waterbury, Conn., were proper.

The complainant bought the material from the government salvage boards and under oath obligated itself to remelt the cases while in its possession and agreed that the material would not be used for any purpose or sold until it had been remelted. The complainant, therefore, contended that the old brass or scrap brass rating of fifth class should be applied.

The Commission admitted that under the contract with the Government the articles were valuable as scrap brass for remelting purposes only, but it held that the articles were not entitled to the scrap brass rating, saying:

> "Under its contract these articles were available to complainant as scrap brass and for remelting purposes only. But it is the character of an article from a transportation standpoint, and not the use to which parties may contract that it shall be put, that determines the rate or rating applicable."

The complaint therefore was dismissed.

MEETING OF THE METAL DIVISION

The first meeting scheduled at the Drake Hotel, Chicago, was a meeting of the Metal Division, which was held Tuesday afternoon, September 25, 1923, at 2 o'clock. There was a good attendance of members and the main subject of discussion was the standard classification of metals, particularly in reference to the provision covering Auto Radiators. After a pretty thorough discussion, it was voted that the classification on such material be changed to read as follows:

AUTO RADIATORS (Copper and Brass)

> FORD—2 lbs. deduction on a Ford plate; ¾ lb. for each iron water connection; 1 lb. for each side sheet iron strip. All other radiators to be subject to deduction for actual iron.

The meeting further voted that this classification should be-

come effective November 1, 1923, and same was approved by the Board of Directors.

Another change made was the classification covering Battery Lead Plates. This was changed to read as follows:

"Shall consist of dry battery lead plates, moisture not to exceed 1 per cent, allowance to be made for wood, rubber and paper and excess moisture."

CHEMICAL EXPOSITION

Headquarters, Grand Central Palace, New York

As the Chemical Exposition closed at the Grand Central Palace on September 22, plans for the 1925 Exposition were already under way. At a meeting of exhibitors, the advisory committee and management on September 20, preliminary arrangements for 1925 were made. The week of September 28 to October 3, 1925, and the Grand Central Palace, New York, were the time and place finally decided upon. Announcement was made at the close of the exposition on September 22 that over seventy-five per cent of space on the first floor had already been contracted for in the 1925 Exposition by present exhibitors. Broad changes and new developments for 1925 are already being considered in the formulation of early plans.

Personals

Frank **Schutz** has been appointed superintendent of the foundry of the Public Service Brass Corporation, of Los Angeles, Cal.

E. D. **Allmendinger** has returned to headquarters at Towson Heights, Baltimore, Md., where he will take charge of the Black & Decker export business.

T. C. **Cornell** has been employed by the Black & Decker Manufacturing Company, as salesman to work in Ohio with headquarters at the branch office in Cleveland.

Henry **Fox**, of Block & Decker Manufacturing Company, succeeds E. D. Allmendinger as salesman in the Detroit territory and his new address is General Motors Building, Detroit.

S. J. **Carroll** has been appointed manager of the Cleveland district for the Merchant & Evans Company, Philadelphia. His headquarters are at 315-17 Champlain avenue, Cleveland.

D. V. **Williamson**, formerly with the American Manganese Bronze Company, Philadelphia, Pa., has joined the Detroit Electric Furnace Company, Detroit, Mich., as sales engineer.

H. G. **Smith** has been made branch manager in charge of the Philadelphia territory including all of Pennsylvania, Delaware and New Jersey, for Black & Decker Manufacturing Company.

H. **Glasofer**, has purchased the Sicania Electro Plating Company, 9-11 Baxter street, New York, and has put in a department for grinding and plating surgical and dental instruments.

William A. Willis, manager of the Copper & Brass Research Association delivered an address before the American Mining Congress in Milwaukee, Wis., September 28, 1923, on The Collective Promotion of Copper and Brass.

J. C. **McElroy**, who has been district manager of the Cleveland district for the Merchant & Evans Company, Philadelphia, has been transferred to the Detroit district as manager, with office at 403 Real Estate Exchange Building, Detroit.

M. A. **Weidmayer** and R. E. **Misener** have been promoted and will take up immediately their new selling duties in the industrial department of Black & Decker Manufacturing Company. Their address is 461 Eighth avenue, New York City.

R. W. **Chandler**, manager of the industrial truck division of Yale & Towne Manufacturing Company, Stamford, Conn., is visiting manufacturing centers in England, France, Belgium, Sweden, Denmark, Norway and Holland within the near future.

Harry Oswell has established a foundry in Massena, N. Y., for Howard C. Munson. Their work will be repairs, job work and manufacture of fire escapes, automatic milk can washing machines, etc. They will cast iron, brass and aluminum.

C. E. **Hoyt**, secretary of the American Foundrymen's Association, sailed from New York on the "George Washington," September 1st, and will join the American foundrymen's tour in London, going later to Paris for the International Foundrymen's Convention.

Robert D. Black, branch manager for the Black & Decker Manufacturing Company, Baltimore, Md., in charge of the Philadelphia territory, will return to headquarters about the middle of November to take up his new duties as advertising manager for the company.

J. P. **Bonardi** has been promoted to the position of sales manager of the New York office of the Mine and Smelter Supply Company, succeeding E. S. Tompkins who resigned recently. For the past two years Mr. Bonardi had been manager of the assay and chemical department of the Denver house.

W. H. **Jelley**, heretofore connected with the office of the Eastern Pennsylvania District of the United American Metals Corporation, at Philadelphia, has been transferred to Pittsburgh, where he will manage the sales of Syracuse Babbitt Metals and Autocrat Bushing Bronze in Western Pennsylvania District.

Deaths

EZRA L. POST

Ezra L. Post, Wallingford, Conn., died at his Summer home at Cosey Beach, Conn., September 12, 1923. He was the inventor of Zero metal, used in bearings on automobiles, and locomotive wheels. Mr. Post was 79 years of age.

WINTHROP N. SPRING

Winthrop N. Spring, secretary of the Berbecker & Rowland Manufacturing Company of Waterbury, Conn., died suddenly of apoplectic shock at his desk in the factory office September 17, 1923. He died almost instantly after complaining of a headache.

Mr. Spring came to Waterbury from Chicago after the death of his wife and other relatives in the Iroquois Theater fire; a shock which caused him to be seriously ill at the time and from which he never fully recovered. Mr. Spring was 50 years of age. He had lived in Waterbury seven years, was a member of the vestry of Trinity church and always deeply interested in the affairs of the parish. His body was removed to the home of relatives in Chicago, where the funeral was held.

DR. HANS GOLDSCHMIDT

Dr. Hans Goldschmidt died suddenly in Baden-Baden, Germany, May 20. He was inventor of the thermit process for welding iron and steel and for producing high-grade metals and alloys, also originator of many other inventions. Dr. Goldschmidt was born in Berlin, January 18, 1861. After graduating from the "gymnasium" of Altenburg, he studied chemistry, physics and natural sciences in general at the universities of Berlin, Leipzig, Heidelberg, Strassburg and the Institute of Technology at Charlottenburg. He entered the firm of Th. Goldschmidt, Essen Ruhr, Germany, in partnership with his brother, Dr. Karl Goldschmidt, in 1887, devoting himself to scientific research. The thermit process, now used extensively for welding iron and steel sections, and for producing metals and alloys, was his most important invention. Prof. Goldschmidt was a frequent visitor to this country and was president of the Goldschmidt Thermit Company, now Metal & Thermit Corporation, New York, from 1904 to 1916.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

October 1, 1923.

Good business for the coming fall and winter is the outlook among brass manufacturers here. **F. S. Chase,** president of the Chase companies, Inc., in answer to an inquiry, stated:

"We believe the underlying conditions are sound in this country and improving abroad and that the settlement which seems imminent between France and Germany is going to have a marked effect on business. Business in the spring was distinctly above normal. It was natural that it should drop off during the summer because of this and because it is generally the case during the hot weather and the vacation period. The price of copper and zinc, considering today's costs, are not unreasonable. Our customers so far as we know have not stocked up. They can use more material and we expect them to order it."

Much the same opinion was expressed at the **American Brass** offices, where it was said that better conditions are looked for this winter. At this plant, it was stated, that while business is slightly slow at present, it could hardly be called slack and the probability is that it will pick up greatly during the Winter. The decrease of business in August was a smaller decrease than is usually experienced in that month.

Although it cannot be officially confirmed, because of absence from the city of **John A. Coe,** president of the company, it is learned on the best of authority that the **American Brass Company** has taken over the **National Conduit and Cable Company** of Hastings, N. Y., one of the largest manufacturing concerns in that city. The negotiations are known to have been in process for some time and it is understood that the deal is now completed.

Ralph E. Day, until the present time, assistant secretary of the American Brass Company, has removed from the city, his departure being simultaneous with the announcement of the purchase of the Hastings' plant and as he has settled in Hastings it is understood on good authority that he is to head the new branch and will have his aides one or more members of the local branch. It will be under his supervision that the new plant will be erected, it is said. Mr. Day is one of the most skilled brass men in the city and has been identified with the American Brass Company most of his life.

Emphatic denial has been made by officials of both the **Chase** and **Scovill** companies of a report published in local papers, to the effect that both concerns were to combine together with a brass and copper company of Rome, New York. **E. O. Goss,** president of the Scovill Manufacturing Company, declared the rumor to be without foundation and the Chase companies stated the report was false as was an earlier report that the concerns were to consolidate with the **Calumet & Hecla Copper Company.**

The manufacturers of Waterbury and surrounding towns of the Naugatuck Valley at a meeting at the Waterbury Club this month, voiced approval of the report of the **Joint New England Railroad Committee** on railroad consolidation. E. O. Goss, president of the Scovill Manufacturing Company, is one of the members of the joint committee, appointed by the governors of the New England states. The meeting also went on record as opposing any consolidation of the New England roads with trunk lines but favored consolidation into one New England system as recommended by the Joint committee. A committee of manufacturers was appointed to attend the hearing before the Interstate Commerce commission in Boston when it discusses the Joint committee report. The local committee includes F. S. Chase, John A. Coe, and George E. Judd of this city, C. D. Bliss of Ansonia and Ralph French of Thomaston.

E. O. Goss has been appointed the personal representative of the Manufacturers' Association of Connecticut to represent it at the railroad consolidation hearing. He will present the statement drafted by the board of directors of the association which also opposes consolidation with trunk lines but favors an all New England system.—W. R. B.

BRIDGEPORT, CONN.

October 1, 1923.

Breach of contract is alleged by the **American Tube & Stamping Company** of this city, in an action for damages of $20,000 filed in the Superior court here against the **Harrisburg Pipe and Pipe Bending Company** of Harrisburg, Penn. According to the allegations, in April of this year, the local concern contracted with the Harrisburg company for delivery of 1,686 gross tons of billets at a stipulated price. The defendant concern failed to make delivery and refuses to do so, although the plaintiffs are still willing to fulfill their end of the deal, the complaint says.

The motion of the **Stamford Extract Manufacturing Company** for an injunction restraining the **Stamford Rolling Mills Company** from disposing of waste in the Noroton river, was denied by Judge William M. Maltbie in a decision rendered in the Superior court last month. The Extract had claimed damages of $100,000, on the ground that the disposing of waste by the rolling mill prevented it from utilizing the water of the river for its own use.

With the issuance of a stock dividend of $1,000,000 voted by directors of the **Bryant Electric Company, Inc.,** last May, the total outstanding capital stock of the concern now reaches $3,000,000. Certificate of the new issue was filed last month in the secretary of state's office in Hartford, signed by E. M. Herr, Waldo C. Bryant, James C. Bennett, L. A. Osborne and Charles A. Terry, directors and officers of the company. Filing of the certificate brought to light the fact that a $1,375,000 issue of stock in June, 1905, was voted. No certificate of this issue was ever filed. It was taken entirely by the **Westinghouse Electric and Supply Company** and at the time made the total outstanding stock amount to $2,375,000. This was later reduced to $2,000,000 prior to the present increase of $1,000,000.

Judge Wright, special master in the U. S. District court at San Francisco, handed down a decision last month, confirming the spring bar patents of the **American Chain Company** of this city, which had brought suit for infringement of patent against the **Chester Weaver Company,** distributors for the so-called **Lyon** bumper made by the **Metal Stamping Company** of Long Island city. This is the second time that the courts have upheld the Hoover patent owned by the American Chain company. In the present case the Metal Stamping Company offered new evidence attacking the validity of the Hoover patent, but the court decided the validity of the patent had been established. The patent was granted to Thomas Hoover of Fresno, Cal., in 1918 and was assigned to the local company in 1920.

Frederick C. Hill, for the past three and a half years secretary of the **Manufacturers' Association** of Bridgeport, has resigned to accept a position of Chief Executive of the Hartford Boy Scouts. Prior to his appointment of secretary of the association he held responsible positions with the American and British Ordnance Company and the Bullard Machine Company.—W. R. B.

TORRINGTON, CONN.

October 1, 1923.

The **Union Hardware Company** has purchased another tract of land near its plant, supplementing a purchase made a few months ago. It has a frontage of 400 feet on West Torrington road and was purchased from Luke D. Brennan.

Torrington on October 1 became a city, the thirteenth city in population in Connecticut. Adoption of a city charter was authorized at the last session of the legislature.

Torrington's splendid new Y. M. C. A. building, made possible by the hearty co-operation of Torrington manufacturers, is to be opened the latter part of this month. **Francis H. Griffiths** of the **Turner & Seymour Manufacturing Company** is president of the association.

James **A. Green** has severed his connection with the Turner & Seymour company, after several years of service as factory superintendent. His resignation became effective September 15. His total period of employment with the company covered a period of nearly twenty years.

The American Legion band during the past month gave a complimentary concert to **Frederick F. Fuessenich,** former president of the **Hendey Machine Company** and donor of Fuessenich park, where band concerts were held weekly throughout the Summer. The concert to Mr. Fuessenich was given on the lawn in front of his home.

The **Torrington Manufacturing Company** has purchased a tract of land across the street from its plant on Franklin street. The property was purchased from **Edward Murphy** and has a frontage of 86 feet. The manufacturing company has no immediate plans for the use of the property, THE METAL INDUSTRY representative was informed.

The **Union Hardware Company** has issued $1,200,000 of unissued capital stock, according to a certificate filed with the secretary of state. All the stock issued is preferred and brings the total outstanding capitalization to $1,800,000.—J. H. T.

ROCHESTER, N. Y.

OCTOBER 1, 1923.

With the Autumn season in full swing a careful inventory of business conditions among Rochester industries of the metal-using class fails to reveal a single industry that is quite so active as a year ago. There is no accounting for this slump, and in July prospects promised a real spurt in business activity so soon as Fall arrived. These facts are stated in a pessimistic way, for it is expected that the situation will improve before snow flies. Manufacturers claim that Rochester is subject to the same influences that interrupt business prosperity on occasions in other cities, and that all industrial centers are hampered more or less this fall.

Brass foundrymen complain of quiet trade, declaring that in but few cases in Rochester brass foundries are now operating at more than two-thirds capacity. Demand is quiet for brass materials and consequently stores of brass and copper stocks have not been heavily drawn on of late.

It is strange that all members of the plating craft are quite busy at this time. Platers at the **Taylor Thermometer Company** and **Northeast Electric Company** have handled a great deal of metal during the past month. The silver-plating industry in Rochester is not extensive, but it is quite active. —G. B. E.

TRENTON, N. J.

OCTOBER 1, 1923.

While the majority of the metal industry plants in Trenton continue busy, business has slackened up a little at the **J. L. Mott Company** factory. Some of the help in the brass department were recently laid off because of a scarcity of work. The **Trenton Brass and Machine Company, Billingham Brass and Foundry Company, Skillman Hardware Manufacturing Company** and other local concerns are running normal yet.

The Trenton metal plants gave liberally to the fund raised for the stricken Japanese.

Federal Judge Runyon has appointed **Ernest W. Bradbury** and **Herbert W. Taylor** ancilliary receivers for the **Witherbee Storage Battery Company, Inc.,** manufacturers, of 234 West Fifty-fifth street, New York. A petition in involuntary bankruptcy was filed in the southern district court of New York. The receivers were placed under $10,000 bonds.

Minerals Refining Company, of 64 South Essex avenue, Orange, N. J., has been incorporated at Trenton with $1,000 capital to manufacture metals and minerals and carry on a smelting and refining business for the treating of metals. The incorporators are Ernest S. Suffern, 11 Crestmont avenue, Montclair, N. J.; Foster Bailey, 163 Overpeck avenue, Ridgefield Park, N. J., Elmer F. Dougherty, 133 Linden avenue, Glen Ridge N. J. The latter has been named agent in charge.

New Jersey Copper Screen Company, of 410 North Broad street, Elizabeth, N. J., has been incorporated at Trenton with $5,000 capital to deal in building material, etc. The incorporators are H. Sidney Landau, 1710 Croton Park, New York; E. Loefelhardt, 1196 President street, Brooklyn, and Carrie H. Gehris, of 105 Clark street, Brooklyn.

United States Cutlery Company, of Belleville, N. J., has been incorporated at Trenton with $300,000 capital to manufacture cutlery. The papers were filed by Bernard Mindes, of Newark.

Waverly Smelting and Chemical Corporation, of Newark, N. J., has been incorporated at Trenton by E. A. and W. A. Schilling.

American Chemical Products Company, of Newark, N. J., has been incorporated at Trenton with $50,000 to manufacture chemicals.

Polychrome Chemical Company, of Newark, N. J., has been incorporated at Trenton with $100,000 capital to manufacture chemicals. The incorporators are Lawrence A. Muench, L. J. Donhauser and August Greener, all of 398 Market street, Newark, N. J.

Novich and Chafetz, Inc., of 790 Broad street, Newark, N. J., has been incorporated at Trenton with $25,000 capital to manufacture iron, steel, brass, lead and minerals. The incorporators are Louis Novich, 1014 Eastern Parkway, Brooklyn; Henry Chafetz, 548 Springfield avenue, Newark, and Nathan Goldberg of 492 Belmont avenue, Newark, N. J.

United Rubber Machinery Exchange, of 49 Marshall street, Newark, N. J., has been incorporated at Trenton with 2,500 shares no par value to deal in metals of all kinds machinery, etc. The incorporators are Sigmond Liebstein, Annie Liebstein and Milton J. Liebstein, all of Newark, N. J.

A certificate of incorporation has been filed at Trenton by the **Metals Holdings Corporation,** of 15 Exchange Place, Jersey City, with George A. Wardell, designated as agent. The authorized capital stock is $200,000, divided into 200,000 shares of $1 parity. The incorporators are Frederick R. Slater, Charles J. Healy and Henry E. Fanshawe, all of New York.

The **Leonard Jewelry Company, Inc.,** of Newark, N. J., has been incorporated at Trenton with $75,000 capital to manufacture jewelry. David N. Pepik filed the papers.

Brown and Bender Manufacturing Company, of 441 New Jersey Railroad avenue, Newark, N. J., has been incorporated at Trenton to deal in aluminum frames and other metal novelties. The incorporators are Martin G. Bender, 151 Linden avenue, Glen Ridge, N. J.; Roger S. Brown, 48 Elm street, Montclair, N. J., and J. Stuart Brown, of 48 Elm street, Montclair, N. J.

The **General Refining Corporation,** of Jersey City, N. J., has been incorporated at Trenton with $25,000 capital preferred and 1,000 shares no par. The company will engage in the manufacture of chemicals.—C. A. L.

PROVIDENCE, R. I.

OCTOBER 1, 1923.

The publication of two tax lists during the past month has been of more than usual interest to the business concerns of this State. The first was the corporate excess and franchise taxes on manufacturing, mercantile and miscellaneous corporations imposed each year by the State Tax Commissioners; and the second was the annual direct property tax assessed by the City of Providence.

The corporate excess, upon which a tax of $4 per $1,000 is levied by the State Tax Board, represents the difference between the total valuation of the corporation's property holdings within Rhode Island, and the assessed valuation by the city or town in which such property is located, less any exemption of any non-taxable property in this State. Included in the State corporation excess list are the following corporations affiliated with the State's metal industries that pay on a corporate excess of $100,000 or more, together with the amount of that excess and the amount of the tax levied by the state:

American Brass Company, $196,892.75 tax, $787.57; **Brown & Sharpe Manufacturing Company,** $4,716,065.81, tax, $18,864.26; **Gorham Manufacturing Company,** $959,271.98, tax, $3,837.08; **Ostby & Barton Company,** $844,785.76, tax, $3,379.14. —W. H. M.

INDIANAPOLIS, IND.

October 1, 1923.

Dr. R. B. Jones and **Alva F. Orcutt** of Laporte, Ind., are directors of the **Hays Brass and Aluminum Foundry Company,** which has been organized with $50,000 for the purpose of establishing a general brass and aluminum foundry in Laporte, Ind. Joseph W. Hays, head of the Hays Corporation at Michigan City, and Philip T. Sprague, also of Michigan City, are the other directors in the new company. The foundry to be built in Laporte will be a branch of the Hays Brass and Aluminum Foundry Company of Michigan City.

Suit on contract, asking royalties in the sum of $1,000 has been filed in the circuit court by the **I. & L. Pump Company** against the **Indiana Brass Company,** Frankfort, Ind. The plaintiffs seek judgment on a royalty basis of two cents of the patented tank flushers alleged to have been manufactured under contract by the Frankfort company.

An alleged fraudulent check artist is reported to be circulating checks on the **Standard Plating Company,** Anderson, Ind. A check for $13 was passed at **Schuster Bros.** and another check for $26 was passed on another uptown store. As far as has been learned the receipts of the crook are only $44 thus far. The name of **W. L. Sharp,** proprietor of the Standard Plating Company, was forged to the checks, it is alleged. Mr. Sharp says he found that a few checks had been torn from a check book that he left on his desk, recently. The Standard Plating Company is enjoying a rapid growth in business. Several large orders for pencil holders and towel racks, novelties made by the concern, have been booked and the amount of plating work booked also has increased.

Roy Hasenohr, Terre Haute, Ind., is announcing the opening of the **T. H. Plating Works** at 723 Rose Court, directly over the **Musick Auto Company** and in rear of the Tribune building. The new firm will make the nickel plating of auto parts their specialty. According to Mr. Hasenohr, all kinds of gold, silver, copper and brass plating as well as renickeling will be done by his firm.—E. B.

DETROIT, MICH.

October 1, 1923.

J. D. Cronenweth, president of the **Grat Lakes Distributing Company** of Detroit, producers and shippers of foundry sands, recently has been elected as a director of the **Lancaster Coal & Sand Company** at New Lexington, Ohio. The latter company has extensive holdings in New Lexington and capacity for 15 cars of No. 4 milled molding sand a day. The Great Lakes Distributing Company here will have the exclusive handling of the output of this mill in the future.

The **Ford** domestic motor car production continues in excess of 40,000 a week. The output for a recent week totaled 40,665 cars. The **Lincoln** division of the Ford Motor company produced 185 cars in one week recently.

D. V. Williamson, at one time president of the Detroit Engineering Society, and formerly assistant sales manager of the **American Manganese Bronze Company,** in Philadelphia, has returned to Detroit and is now sales manager for the **Detroit Electric Furnace Company.**

The Great Western Smelting and Refining Company with headquarters in Chicago, are erecting a new warehouse and smelting plant on Russell street, running from Woodland avenue to the city limits. The plant covers about one acre, all on one floor with added yard space of another acre. It will be equipped with the most modern apparatus for the handling, grading and smelting of metals. The architect is Albert Kahn, of Detroit. The company is expected to move into the new plant about December 1.

A permit has been issued to Smith, Hinchman & Grylls, 800 Marquette building, contractors for the erection of an addition to the plant of the **Detroit Lubricator Company,** 5938 Trumbull avenue, to cost $331,000.

The Wolverine Metal Specialties Company has recently been organized at Grand Rapids to control and dispose of all kinds of metal parts, dies, etc. Those interested are Anna DeGraaf, 1040 Lafayette avenue, C. H. Jennings and J. Claude Youdan, all of Grand Rapids. The capital stock is placed at $100,000.

The Saginaw Pattern Works at Saginaw is another concern that has just been organized. The partners are Albert J. Fox and C. C. Wood. Headquarters of the partnership is at 217 North Water street. Mr. Fox formerly was superintendent of the pattern works of the Buick Motor Company and Mr. Wood formerly was superintendent of the pattern construction of the Central Foundry Company, Saginaw. The partners will make patterns, brass and aluminum castings and will employ about 50 men.

Henry Ford has declared here in an interview that aluminum will take the place of iron to a greater extent in the future. "Every clay bank has aluminum in it and we are going to take it out," he said.

"When will you begin to do this," he was asked.

"When we get Muscle Shoals. Aluminum will do the thing which I always have wanted to do for the Ford car," Mr. Ford added, "make it lighter. It is top heavy. It has 30 pounds of 'water' in it, and if I can eliminate that I can make it much lighter. But in the meantime iron will play its basic part in industry for a long time to come."

More than 100 members of the **National Association of Ornamental Iron & Bronze Manufacturers** held a three-day session here beginning Sept. 27. Delegates were present from all over the United States representing both big and little concerns. Among the principal speakers was **Charles F. Waltz** of Cincinnati, secretary of the association. "Quality production and that on short notice and specified time," he declared, has gone a great way toward changing the character of our output. Quality, rather than beauty, has been generally accentuated largely because we do not have sufficient time to devote to the creative and artistic side of metal work. In the old days, and especially in Europe, the apprentice rule was strictly adhered to and the result was that when a man became a journeyman, he was a skilled artizan influenced by artistic impulses. Conditions, instead of being inimical to the development of ideals, encouraged them and a man took pride in turning out fine work."—F. J. H.

PITTSBURGH, PA.

October 1, 1923.

Expected revival of business in the manufacturing industry, which is closely allied with the metal business is somewhat delayed, but a spirit of optimism prevails in nearly all quarters. It is believed the stage is set for an active fall and winter.

For the first time in a year a surplus of first-class general machinists is apparent in the Philadelphia district. The pronounced shortage, however, of molders, patternmakers, cabinetmakers and shipjoiners continues. First-class automobile mechanics are also difficult to obtain.

Electrical supplies are selling in fair volume. There is good call for electric iron and toasters. Heatings have been selling well since the cool wave began. House wiring accessories are in fair request.

In Philadelphia, plumbing dealers say they are doing an excellent business. The building trade is calling for large quantities of pipe and fittings. Sanitary fixtures are selling in good volume. Prices are well maintained.—H. W. R.

MONTREAL, CANADA

October 1, 1923.

The situation in the metal industry on the whole indicates material improvement and indicates that Fall business will be good.

Lawford Grat, managing director of the **Eugene Philips Electrical Works, Ltd.,** has announced that the second unit of their new factory buildings is now in course of erection. The first unit of the company's plant is now removed from Montreal to Brockville, Ontario. It was erected last year in the form of a rod-mill.

The Chas. Wamsley Company, Ltd., has taken over the plant recently vacated by the **Armstrong-Whitworth Company** here and will manufacture paper pulp machinery, hydraulic electric marine and general engineering castings in gray iron, steel and brass on an extensive scale. The parent concern, Chas. Wamsley and Company, Bury, Lancashire, England, has been in business over forty years and is famous

as the maker of one of the widest paper making machines ever constructed, the rollers being 234 inches long. Other specialties are Pelton wheels and canal lock gates to accommodate ships of any tonnage. Officials of the new company are Harry Kay, vice-president and general manager; **D. Haig,** secretary-treasurer; **James Craig,** foundry manager, and **S. Entwistle** foundry superintendent.

The **Cuthbert Brass Company,** Duke street, is building an addition to the foundry to take care of increasing business. The new addition will be occupied when completed as the core department and equipped with electric ovens and core machines.—P. W. B.

BIRMINGHAM, ENGLAND

SEPTEMBER 13, 1923.

Business in the metal trades was dull at the beginning of this month, but in many departments has now regained a level which in view of the experiences of the last two years may be regarded as satisfactory. Export orders for brassfoundry are increasing whilst the prospects of the home trade are improved by the gradual increase of activity in building. Cabinet brassfoundry is in better demand. Home requirements are still small, but a number of small orders have been received for export. South America appears to be re-opening as a market for British brass products. Very little business is being done with the new Continent, and Holland is still the chief customer. Manufacturers of gas and electrical fittings are busy with requirements for the winter and the seasonal demand both at home and abroad appears likely to be greater than it was a year ago. A growing preference is shown for fittings of better quality and more artistic design. Considerable enterprise is being shown by lamp manufacturers in regard to new designs and construction in paraffin and petrol lamps. The prospects of the trade are considered to be good. Special attention is being given to the production of pressure lamps both for indoor lighting and in hurricane and other outdoor lanterns. Hearth furniture manufacturers are well employed but this is mainly a home trade. Wire drawers in most departments have plenty of work, but the delay in settling license conditions for "listening in" has prevented any revival of demand for wire and fittings for wireless telephone sets. In the metallic bedstead trade, as the result of the withdrawal of price control by the Manufacturers' Federation there has been an all round reduction of prices, and a determined effort is being made to recapture the trade which was lost through the vogue of the wooden bedstead. A number of new designs in brass bedsteads with a choice of surface finishes have been put on the market at extremely low prices and some firms are offering goods to the storekeeper on "sale or return" terms. But practically no headway has been made in the home trade whilst export business shows no improvement. Rollers in most branches of the sheet metal trade have a fair amount of work as have also the makers of extruded, pressed and other metal materials. Birmingham jewellers are still poorly employed, but a few especially in the cheaper lines, are now getting a little increase in business. Silversmiths and electro-platers also find business moving slowly. Makers of spoons and forks are the best employed, a great portion of the remaining business being in miscellaneous electroplated articles, many thousands of which are given away as prizes under advertising schemes. The scrap metal market is dull and prices show a falling tendency.—G.

Business Items—Verified

The **E. N. Cooke Company,** Warsaw, Ind., is starting a brass and nickel plating plant.

The **Penn Brass & Copper Company,** Erie, Pa., has completed a new mill for the manufacturing of seamless brass and copper tubes and is now producing.

The **Crown Rheostat & Supply Company,** 31-33 South Desplaines street, Chicago, Ill., is receiving bids through an architect on a two-story factory, 50 x 72 feet, 1908-1914 Parker avenue, to cost $28,000.

The **Dempsey Furnace Company,** 15 Park Row, New York City, has acquired factory premises at 61-63 Cornelison avenue, Jersey City, N. J., where it will manufacture industrial oil burning equipment, as well as the furnaces associated with its name.

The **Seaford Metal Products Company,** Seaford, Del., has started to manufacture ash separators. This concern also furnishes, installs and erects metal ceilings and walls, metal lath and cornice, and desires to act as representative for manufacturers of the above materials.

The **Keeler Brass Company,** 947 Godfrey Avenue, Grand Rapids, Mich., has let contract for the erection of a one-story addition. M. S. Keeler is president. This firm operates the following departments: brass foundry, brass machine shop, tool room, spinning, plating, japanning, stamping, polishing, lacquering.

The **Great Western Smelting & Refining Company,** 75 Folsom street, San Francisco, Cal., has plans out for bids for the erection of its proposed one-story foundry, 138 x 275 feet, at Spear and Folsom streets, estimated to cost $75,000. Excavations will soon be placed in progress. This concern operates a smelting and refining department.

The **Reproducto Manufacturing Company,** Newport News, Va., has just erected a new plant for the manufacture of small metal parts, and will be in the market before long, for plating, stamping and polishing equipment. The tool room is now in operation. This concern operates the following departments: plating, stamping, polishing, tool room.

The **Lebanon Brass Works,** Lebanon, Pa., is in the market for a high-speed direct-connected polishing and buffing lathe, and is also considering the purchase of tumbler for brass castings and japanning equipment. This concern operates the following departments: brass, bronze and aluminum foundry, casting shop, plating, polishing, lacquering.

The **Armstrong Cork & Insulation Company,** Pittsburgh, Pa., announces the removal of the Boston, Mass., office to 275-285 Congress street. The new location gives the company greatly extended warehouse facilities. The Boston office now carries a large stock of Nonpareil insulating materials from which its customers in that territory can be supplied promptly. F. W. Robinson is manager.

The **Driver-Harris Company,** Harrison, N. J., has advised the trade that reports that its plant was recently damaged by a fire which destroyed the Newark ball park, which adjoins its plant, are not correct. No damage was done to plant or equipment and deliveries are not being held up as a result of the fire. This concern operates the following departments: nichrome foundry, casting shop, rolling mill.

It is announced by the **Black & Decker Manufacturing Company,** Baltimore, Md., that the five-sixteenths inch drill is reduced from $65.00 to $52.00. This company states that it is its policy to reduce prices to the user as soon as reduction in manufacturing costs makes this possible and that reductions will not be made at any specified times or seasons, but whenever manufacturing conditions make it possible.

The **Nassau Smelting & Refining Works, Ltd.,** 603 West 29th street, New York, has awarded a general contract to the Levering & Carrigues Company, 552 West Twenty-third street, for the erection of a group of 1-story plant buildings on local site, for metal smelting and refining, estimated to cost in excess of $100,000 with equipment. Benjamin Lowenstein is president. This concern operates a smelting and refining plant.

The **United Metal Products Company,** recently incorporated in Ohio, and located at Canton, has purchased the properties of the former Central Metal Products Corporation and will continue in the manufacture of hollow metal doors and trim as well as rolled and drawn bronze and steel moldings for the architectural, automotive and other fields. This concern operates the following departments: tool room, grinding room, japanning.

W. A. Klein, Lapeer, Mich., formerly located at Columbiaville, Mich., is organizing a local company to establish and

operate plant for the manufacture of a line of metal products. Space has been leased in the Krolick building, and it is purposed to install equipment at an early date, having the plant ready for service before the close of September. This concern operates the following departments: smelting and refining, casting shop, japanning, stamping.

The **National Lead Company,** 111 Broadway, New York City, has awarded a general contract to Rufus H. Brown Company, 356 Pearl street, Brooklyn, for the erection of a five-story steel and concrete research laboratory at 105 York street, Brooklyn. The building will be about 47 x 90 feet. This building will be the research laboratory of the National Lead Company, and will be devoted to research work and other problems in connection with metals and other products manufactured by the company.

The **Parker Wire Goods Company,** Washington and Lamartine Streets, Worcester, Mass., purposes to develop a metal-stamping business, in connection with its regular standard and special wire goods production, and has enlarged the stamping department for immediate requirements. The new plant, recently completed, is now in operation and will be advanced to maximum output. They are also in a position to furnish screw machine items. This firm operates the following departments: brazing, japanning, stamping, tinning.

The **Wolff Manufacturing Company,** manufacturer of plumbing supplies, Chicago, Ill., has purchased the foundry of the Brady Foundry Company, Chicago, a plant containing 100,000 feet of floor space at the northeast corner of Western avenue and Forty-fifth street. With additions and alterations now being planned the Wolff Manufacturing Company will convert this plant into one of the largest bath tub foundries in the country. This concern operates the following departments: brass foundry, brass machine shop, tool room, grinding room, galvanizing, plating, stamping, polishing.

A decision in favor of **Remington Arms Company, Inc.,** has just been handed down by Judge Hugh M. Morris of the United States District Court at Wilmington, Delaware, in the patent infringement suit of the **National Cash Register Company** of Dayton, Ohio, against the Remington Company. This suit was filed by the National Company immediately after the Remington cash register was placed on the market about two years ago, and alleged infringement by the sale of that machine of three patents owned by the National Company. In the present decision the Court found two of the patents invalid and the third not infringed.

INCORPORATIONS

The **Oregon Aluminum Manufacturing Company,** Portland, Ore., has been incorporated with a capital stock of $10,000, for the purpose of manufacturing aluminum cooking utensils, especially a patented self-basting roaster.

Jacob & Company, Inc., Indianapolis, Ind., has been incorporated to manufacture metal products and composition specialties. A building has been leased at 635 South Delaware street and work has begun on a limited scale. Paul R. Jordan heads the company.

BUSINESS TROUBLES

McCambridge Company, Philadelphia, Pa., is in bankruptcy; David A. Longacre, 1011 Chestnut street, Philadelphia, is receiver. The business is shut down at present, and a sale will shortly be held by the receiver of the business in its entirety.

COPPER IN CLIPPER SHIPS

Professor Morison writes in his "Maritime History of Massachusetts" about the splendid old ships which, from the standpoints of speed, endurance and appearance, reached the high-water mark of sailing vessel construction.

One of the outstanding clippers was "The Glory of the Seas," built in East Boston in the early sixties by Donald McKay, premier American builder of the era of clipper ships.

Some time ago announcement was made in Seattle that the Glory was to be burned in order to salvage the copper and brass in her hull, for the metal is entirely unaffected by the action of time and the elements, after more than a half century of constant exposure to corroding influence.

It is told that the Glory was actually being towed down Puget Sound to be beached and burned, when a telegram from Boston was received, stating that certain Boston ship-

For LONDON,
To sail positively on the 10th instant.
The superior coppered and copper fastened ship ACASTA, A. H. Griswold, master, a regular trader, having her cargo all engaged, will sail positively on the 10th of August, weather permitting. For passage only, having superior furnished State Rooms in the cabin, and a very commodious Steerage, apply on board, at Pine street wharf, or to JOHN GRISWOLD, or au 5 SAML. W. COATES, 68 South-st.

FOR LONDON,
The fast sailing coppered and copper fastened ship COMET, Moore, master, having half of her cargo engaged, will meet early dispatch. For freight of the remainder or passage, having very handsome accommodations, apply on board, west side Fly market wharf, or to JNO. GRISWOLD, or S. W. COATES, au 5 68 South street.

WILLIAM CAIRNS having connected himself with CHARLES W. ROGRS, for the purpose of transacting commission business, under the firm of CAIRNS & CO. offer for sale at

SAILING NOTICES OF COPPERED SHIPS

ping men, moved by a praiseworthy sentiment, wished to purchase the old ship, in order to bring her to Boston, rig her exactly as she was in the days of her prime, and moor her in Boston harbor, as a monument to the finest type of sailing vessel ever built.—COPPER AND BRASS RESEARCH ASSOCIATION.

HUGE COPPER WIRE PLANT

One of the largest copper wire mills in the world, with an ultimate capacity of 70,000,000 pounds of copper wire a year, is expected to be completed late this year when a group of buildings now under construction at the **Western Electric Company's** plant at Hawthorne, Chicago, Ill., is finished.

The building and machinery will cost $2,500,000 and will have a floor area of 96,000 square feet. The output of copper wire will be devoted exclusively to telephone apparatus. The rod mill plant will consist of three mills, one for roughing the copper billets into bars, an intermediate mill for "breaking down" the bars, and a finishing mill for rolling them into one-quarter inch copper rods. The rods will be carried by monorail to the pickling tanks and then to the wire drawing plant. The wire drawing machines will start with a combined capacity in excess of 41,000,000 pounds of wire a year, enough to encircle the earth approximately 310 times.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America	$100	$465	$510
American Hardware Corporation	100	55	57
Anaconda Copper	50	38⅞	39⅛
Bristol Brass	25	5	9
International Nickel, com	25	11¾	12
International Nickel, pfd	100	76	78
International Silver, com	100	60	...
International Silver, pfd	100	102	105
National Conduit & Cable	100	¼	⅜
National Enameling & Stamping	100	47	47½
National Lead Company, com	100	120½	122
National Lead Company, pfd	100	111	113½
New Jersey Zinc	100	140	145
Rome Brass & Copper	100	115	125
Scovill Manufacturing Company, new	..	185	190
Yale & Towne Manufacturing Co., new	..	62	64

Corrected by J. K. Rice, Jr., Co., 36 Wall Street, New York.

TRADE PUBLICATIONS

Bakelite Lacquer.—A pamphlet issued by the General Bakelite Company, 8 West 40th street, New York, describing Bakelite lacquered brass bed.

"Hisey."—A miniature catalogue, No. 3027, issued by Hisey-Wolf Machine Company, Cincinnati, Ohio. It briefly describes the complete line of Hisey products.

Bristol-Fuller Controller Valve. Bulletin 319, issued by the Bristol Company, Waterbury, Conn., on their Bristol-Fuller controller valves for air, gas, water, oil and steam.

"Buckeye."—A folder issued by the Buckeye Products Company, 919-29 West Fifth street, Cincinnati, Ohio, on their high temperature furnace cement for non-ferrous metal melting practice.

Oxidizing.—A folder entitled "When You Think of Oxidizing" issued by the Sulphur Products Company of Greensburg, Pa., explaining the use of Liquid Sulphur for this purpose on numerous products.

Kennedy Products.—General catalogue, seventh edition, issued by the Kennedy-Van Saun Manufacturing and Engineering Corporation, 50 Church street, New York. This catalogue contains illustrations and descriptions of the above company's gyratory crusher. They specialize in the manufacture of jaw crushers, gyratory crushers, combination ball-tube mills, ball mills, tube mills for wet and dry grinding, etc.

Review of the Wrought Metal Business

Written for The Metal Industry by J. J. WHITEHEAD, President of the Whitehead Metal Products Company of New York, Inc.

With the close of the month of September there was a very distinct air of pessimism throughout the brass and copper industry. A strong feeling prevailed that there would be another reduction in prices and this feeling was shown to be justified by the change in the discount from extras which became effective October 1. The new discount from the extras is 25% in place of the 10% which has been in effect for several years. A feeling of uncertainty still prevails and purchasing is being done on a very much restricted scale. Some of the mills have recently gone on a temporary five-day schedule.

Nobody seems to be willing to make a prediction as to what is likely to occur in the trade, but, with the moderate amount of business that is being placed and the condition of depletion that exists in stocks of manufacturers and jobbers, it seems reasonable to suppose that there must very shortly be a reasonably good size buying movement started. As it is not anticipated that prices will go very much, if any, below the present level, it is believed that some buyers may take advantage of the present low price position to cover their forward commitments.

The business in nickel, nickel alloys and Monel metal, has of course, been affected to some extent by the general falling off in the metal trade as a whole. In the past week or two, however, there have been some good orders placed for Monel metal which ran into very heavy tonnages. One of the recent developments in the application of Monel metal to new uses has been made by using it for drinking water tanks in Pullman cars and passenger cars, generally, throughout the country which had heretofore been made for the most part of galvanized iron. The application of nickel in connection with the manufacture of cooking utensils for the hotel and restaurant field is developing rapidly.

As a result of the new applications which have been developed, a large amount of tonnage in these metals has been sold, and the volume of business thus developed has offset to a large extent, the falling off in business in the general lines of trade.

Metal Market Review

Written for The Metal Industry by METAL MAN

COPPER

Freer offerings and a sagging market were outstanding features in copper recently. A fairly active demand for both domestic and foreign account were in evidence from time to time during the past month, but the apathetic attitude of buyers operated against pronounced market improvement. The local market fluctuated between 13¼ cents and 13⅞ cents for electrolytic, with relatively little business at the top figures.

Production is being maintained at a high rate at leading mines. Consumers are consequently disposed to buy carefully in view of the large supplies coming forward every month from the chief producing districts. Holders were offering concessions in order to attract buyers and in efforts to dispose of shipments as they became available. Business was secured at the sacrifice of values, and this feature of the situation has been prominent for several weeks. The October opening indicated further weakness and offerings of electrolytic at 13⅜ cents, with some producers still quoting 13½ cents for balance of the year.

ZINC

Export interest and buying for foreign shipment in September contributed considerable support to the market for zinc. Moderate buying by the brass trade and galvanizers furnished an outlet for enough supplies to prevent domestic stagnation, but local requirements were too restricted to keep the market from sagging.

The market lost ground recently owing to a large increase in stocks. Prime Western is quoted at 6.30 cents to 6.35 cents at E. St. Louis and 6.65 to 6.70 cents, New York. These prices compare with 6.52½ to 6.57½ cents at E. St. Louis and 6.87½ to 6.92½ cents in the early part of September. Production in August was 41,625 tons and shipments 36,394 tons, so that the stocks in smelters' hands were increased 5,231 tons, being 26,471 tons on August 31st, against 16,574 tons on January 31st. Stocks are now the largest in over a year. The October opening was easy with both foreign and domestic demand temporarily quiet.

TIN

Singapore, London and New York have vied with each other lately in holding the attention of buyers. The market has displayed considerable latent strength in the past month, and despite free selling at the source of supply, prices have kept up remarkably well. There was a reduction in visible stocks at the end of August amounting to 1,265 tons, thereby making the world's visible supply at that time 18,754 tons, as against 20,019 tons on July 31st and 25,242 tons on August 31, 1922.

Early in September there were sharp price advances in all markets and the general sentiment in regard to the outlook for the next few months appeared to be favorable for firm conditions. There has been progressive improvement in the statistical position which gives a good underlying foundation for reasonably steady markets for tin for some time.

The market on October 1 opened steady at 41¾ to 42¼ cents for Straits tin, with an advance of £3. 5s. 0. in the London market to £205. 15s. per ton.

LEAD

The peculiar position of the lead situation continues favorable to market firmness. Spot metal is scarce and demand for consumption equal to available supplies for prompt and near future shipment, hence the hopeful outlook for this market as a natural consequence. A partial reaction occurred a short time ago from the peak price of 8¼ cents last March, but the policy of keeping down surplus stocks has maintained the market on a genuinely sound foundation.

The leading producer quotes 6.85 cents, New York, but

offerings at that figure are limited. Outside holdings are quoted at 7.10 cents, and October supplies are moderate.

ALUMINUM

A fair demand continues for aluminum, and consumers' orders keep stocks moving in a quiet way on the basis of 26 to 27 cents for virgin ingot for the 99% material and 25 to 26 cents for the 98-99% metal. Future deliveries might be obtainable at some concession in price, but trading is dull. The undertone of the market is steady, with no indications of special change one way or the other in the immediate future. The tendency, however, appears to be in buyers' favor.

QUICKSILVER

Price of quicksilver has declined to $61 for 75-pound flask. Demand is quiet and the domestic and foreign offers lately are all in buyers' favor.

PLATINUM

Though there is no considerable amount of activity, price is maintained at $116 per ounce. Shortage of supplies has sent the price up from $47 an ounce in 1915 and $108 per ounce in 1917 to quotation now in force.

SILVER

Recent sales of silver bullion were in large volume in September. There were large transactions in the London market and good sales here at better prices. Quotations at end of last month were from 64 to 64¾ cents per ounce. Demand from China improved lately, and the Japanese situation is expected to make for firmer prices. A silver export association was organized recently at a special conference of the Senate Gold and Silver Commission, held at Reno, Nevada. More than 75% of the total yearly silver production was represented at the conference, according to reports.

ANTIMONY

Offers of antimony for shipment from the Far East are very reserve lately and quotations are higher than a short time ago. Holders have advanced asking price of regulars to 7.65c to 7.75c duty paid in carload lots. This price could be shaded for future delivery, but buyers here display only moderate interest. China is firm and the firmer tone is based on prospect of light offerings from the Orient.

OLD METALS

Trading in old metals has been slow and the market dull for several weeks. Dealers and jobbers are hopeful, however, that needs for fourth quarter will soon be manifested, though recent inquiries do not give much ground for optimism as regards prices, except for old lead, which is in good demand at fair prices. Foreign orders have been received here lately for brass and copper scraps. Domestic consumers are conservative in bidding for scrap copper specially, but the white metals were salable to a moderate extent at current prices. Dealers are buyers on basis of 12¼c to 12⅜c for strictly crucible copper, 9¼c to 9¾c for light copper, 6¼c for heavy brass, 8c to 8½c for high brass clippings, 17¼c to 18c for aluminum clippings, 6c to 6⅛c for heavy lead, 3¾c to 4⅛c for battery lead, and 4¼c to 4½c for old zinc scrap.

WATERBURY AVERAGE

Lake Copper—Average for 1922, 13.844—January, 1923, 14.875—February, 15.75—March, 17.25—April, 17.125—May, 16.125—June, 15.25—July, 15.00—August, 14.50—September, 14.00.

Brass Mill Zinc—Average for 1922, 6.283—January, 1923, 8—February, 8—March, 8.70—April, 8.25—May, 7.60—June, 7.00—July, 6.80—August, 7.10—September, 7.30.

Daily Metal Prices for the Month of September, 1923

Record of Daily Highest, Lowest and Average

Metal Prices for October 5

Date	4	5	6	7	10	11	12	13	14	17	18	19
Copper (f. o. b., Ref.) c/lb. Duty Free.....												
Lake (Delivered)	14.00	14.00	14.00	14.00	14.25	14.25	14.25	14.25	14.25	14.00	14.00	13.75
Electrolytic	13.80	13.80	13.80	13.80	13.85	13.85	13.85	13.80	13.70	13.60	13.45	13.40
Casting	13.625	13.625	13.625	13.625	13.625	13.625	13.625	13.55	13.50	13.375	13.25	13.125
Zinc (f. o. b., St. L.) c/lb. Duty 1¼c/lb.....												
Prime Western	6.50	6.55	6.55	6.55	6.55	6.55	6.55	6.55	6.50	6.45	6.45	6.40
Brass Special	6.65	6.65	6.65	6.65	6.65	6.65	6.65	6.65	6.65	6.60	6.60	6.55
Tin (f. o. b., N. Y.) c/lb. Duty Free.....												
Straits	41.375	41.375	41.875	42.125	42.00	42.25	42.25	41.50	41.00	41.00	41.50	41.50
Pig 99%	40.75	40.75	41.25	41.375	41.375	41.50	41.625	41.00	40.50	40.375	41.00	41.00
Lead (f. o. b., St. L.) c/lb. Duty 2½c/lb....	6.70	6.75	6.75	6.75	6.75	6.75	6.75	6.85	6.85	6.80	6.80	6.80
Aluminum c/lb. Duty 5c/lb.....	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50	26.50
Nickel c/lb. Duty 3c/lb.....												
Ingot—Internat. Nick. Co.....	29	29	29	29	29	29	29	29	29	29	29	29
Outside Spot	28	28	28	28	28	28	28	28	28	28	28	28
Electrolytic (Internat. Nick Co.).....												
Ni.—99.80 contam. impur.—.14.....	32	32	32	32	32	32	32	32	32	32	32	32
Brit. Amer. Nick. Corp.....												
Ni.—98.50 contam. impur.—.80.....	30	30	30	30	30	30	30	30	30	30	30	30
Antimony (J. & Ch.) c/lb. Duty 2c/lb.....	7.50	7.50	7.50	7.50	7.55	7.55	7.55	7.55	7.55	7.55	7.55	7.55
Silver (foreign) c/oz. Duty Free.....	63.125	63.00	63.125	63.75	63.75	64.50	63.75	64.125	64.125	64.375	64.375	64.625
Platinum $/oz. Duty Free..... 116	116	116	116	116	116	116	116	116	116	116	116	116

Date	20	21	24	25	26	27	28	High	Low	Average	Oct. 5
Copper (f. o. b., Ref.) c/lb. Duty Free.....											
Lake (Delivered)	13.75	13.75	13.75	14.00	14.00	14.00	13.75	14.25	13.75	14.00	13.50
Electrolytic	13.45	13.50	13.50	13.65	13.55	13.50	13.45	13.85	13.40	13.647	13.25
Casting	13.125	13.25	13.25	13.375	13.25	13.25	13.15	13.625	13.125	13.412	13.00
Zinc (f. o. b., St. L.) c/lb. Duty 1¼c/lb.....											
Prime Western	6.40	6.40	6.40	6.45	6.40	6.40	6.35	6.55	6.35	6.471	6.30
Brass Special	6.55	6.55	6.55	6.60	6.55	6.55	6.50	6.65	6.50	6.603	6.45
Tin (f. o. b., N. Y.) c/lb. Duty Free.....											
Straits	41.25	41.125	42.125	42.375	41.75	41.25	41.375	42.375	41.00	41.632	42.75
Pig 99%	40.75	40.625	41.50	41.75	41.125	40.75	40.875	41.75	40.375	41.046	42.00
Lead (f. o. b., St. L.) c/lb. Duty 2½c/lb....	6.75	6.75	6.75	6.75	6.75	6.70	6.70	6.85	6.70	6.761	6.70
Aluminum c/lb. Duty 5c/lb.....	26.50	26.50	26.50	26.50	26.50	26.50	27.00	27.00	26.50	26.553	27.00
Nickel c/lb. Duty 3c/lb.....											
Ingot—Internat. Nick. Co.....	29	29	29	29	29	29	29	29	29	29	29
Outside Spot	28	28	28	28	28	28	28	28	28	28	28
Electrolytic (Internat. Nick Co.).....											
Ni.—99.80 contam. impur.—.14.....	32	32	32	32	32	32	32	32	32	32	32
Brit. Amer. Nick. Corp.....											
Ni.—98.50 contam. impur.—.80.....	30	30	30	30	30	30	30	30	30	30	30
Antimony (J. & Ch.) c/lb. Duty 2c/lb.....	7.50	7.50	7.50	7.50	7.55	7.65	7.75	7.75	7.50	7.545	7.60
Silver (foreign) c/oz. Duty Free.....	65.25	65.125	65.25	65.25	64.875	64.75	64.00	65.25	63.00	64.270	63.875
Platinum $/oz. Duty Free..... 116	116	116	116	116	116	116	116	116	116	116	116

Metal Prices, October 5, 1923

INGOT METALS AND ALLOYS

Brass Ingot, Yellow	9¼to11¼
Brass Ingots, Red	12¼to14
Bronze Ingot	13½to15
Bismuth	$2.75
Cadmium	85 to95
Casting Aluminum Alloys	21 to24
Cobalt—97% pure	$2.75-3.00
Manganese Bronze Castings	22 to35
Manganese Bronze Ingots	13 to16
Manganese Bronze Forging	33 to42
Manganese Copper, 30%	28 to45
Magnesium Metal	$1.25-1.50
Parsons Manganese Bronze Ingots	19½to21
Phosphor Bronze	24 to30
Phosphor Copper, guaranteed 15%	18½to22
Phosphor Copper, guaranteed 10%	18 to21½
Phosphor Tin, guaranteed 5%	48 to58
Phosphor Tin, no guarantee	48 to56
Quicksilver	$61-$62
Silicon Copper, 10%...according to quantity	28 to35

OLD METALS

Buying Prices		Selling Prices
11 to11¼	Heavy Cut Copper	12½to13
10½to10¾	Copper Wire	12 to12¼
9 to 9¼	Light Copper	10¼to10¾
9 to 9¼	Heavy Machine Comp	10½to11
6¼to 6½	Heavy Brass	8½to 9
5 to 5½	Light Brass	6¼to 6¾
6½to 6¾	No. 1 Yellow Brass Turnings	7¼to 8¼
8¼to 8½	No. 1 Comp Turnings	9 to 9¾
5¾to 6¼	Heavy Lead	6¼to 6½
2¾to 3½	Zinc Scrap	3¾to 4¼
8¼to 8¾	Scrap Aluminum Turnings	10¾to11¼
14¼to14¾	Scrap Aluminum, cast alloyed	16¼to16¾
15¼to16¼	Scrap Aluminum, sheet (new)	17¼to18¼
22¼	No. 1 Pewter	26¼
13¼	Old Nickel anodes	15¼
21¼to23¼	Old Nickel	25¼to27¾

BRASS MATERIAL—MILL SHIPMENTS

In effect Sept. 18, 1923

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.18	$0.19¾	$0.21½
Wire	0.18½	0.20¼	0.22
Rod	0.15¾	0.20½	0.22¼
Brazed tubing	0.26	.....	0.31¼
Open seam tubing	0.26	.....	0.31¼
Angles and channels	0.29	.....	0.34¼

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.19	$0.20¾	$0.22½
Wire	0.19½	0.21¼	0.23
Rod	0.16¾	0.21½	0.23¼
Brazed tubing	0.27	.....	0.32¼
Open seam tubing	0.27	.....	0.32¼
Angles and channels	0.30	.....	0.35¼

SEAMLESS TUBING

Brass, 23c. to 24c. per lb. base.
Copper, 24¼c. to 25½c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	20c. net base
Muntz or Yellow Metal Sheathing (14"x48")	18c. net base
Muntz or Yellow Rectangular Sheets other than Sheathing	19c. net base
Muntz or Yellow Metal Rod	16c. net base

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	21¾c. to 22¾c.
From stock	22¾c. to 23¾c.

BARE COPPER WIRE—CARLOAD LOTS

16⅛c. to 16¼c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order	20c. per lb. base
100 lbs. to 200 lbs. in one order	20¼c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.

Carload lots, standard sizes and gauges, at mill, 9¼c. basis less 8 per cent. discount.

Casks, jobbers' prices	10¾c. to 11½c.
Open casks, jobbers' prices	11½c. to 12½c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price	37c.
Aluminum coils, 24 ga. and heavier, base price	35c.
Foreign	45c.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10%	Quality	25½c. per lb.
15%	"	26¾c. per lb.
18%	"	28c. per lb.

Nickel Silver Wire and Rod

10%	"	28½c. per lb.
15%	"	32c. per lb.
18%	"	35c. per lb.

MONEL METAL

Shot	32
Blocks	32
Hot Rolled Rods (base)	40
Cold Drawn Rods (base)	48
Rot Rolled Sheets (base)	42

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheets—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25c. over. Above prices f. o. b. mill.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 67½c. to 69½c. per Troy ounce, depending upon quantity.

Rolled sterling silver 65c. to 67c.

NICKEL ANODES

85 to 87% purity	31½c.-34c. per lb.
90 to 92% purity	34c.-35c. per lb.
95 to 97% purity	36c.-37c. per lb.

Supply Prices, October 5, 1923

CHEMICALS

In Commercial Quantities—New York Prices

Acetone	lb.	.24½–.27
Acid—		
Boric (Boracic) Crystals	lb.	.12
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg. Carboys	lb.	.06
Nitric, 42 deg. Carboys	lb.	.07
Sulphuric, 66 deg. Carboys	lb.	.02
Alcohol—		
Butyl	lb.	.45-.50
Denatured in bbls.	gal.	.38–.45
Alum—		
Lump, Barrels	lb.	.04
Powdered, Barrels	lb.	.04½
Aluminum sulphate, commercial tech	lb.	.02½–.03
Aluminum chloride solution	lb.	.22
Ammonium—		
Sulphate, tech., Barrels	lb.	.03¾
Sulphocyanide	lb.	.65
Argols, white, see Cream of Tartar	lb.	.27
Arsenic, white, Kegs	lb.	.16
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Blue Vitriol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.06
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.07
Chrome Green, bbls.	lb.	.39¼
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.37
Carbonate, Barrels	lb.	.20
Cyanide	lb.	.46
Sulphate, Barrels	lb.	.06½
Copperas (Iron Sulphate, bbl.)	lb	.02
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05–.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	6.75
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron, Sulphate, see Copperas, bbl.	lb.	.02
Lead Acetate (Sugar of Lead)	lb.	.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	1.15
Nickel—		
Carbonate Dry	lb.	.40
Chloride, 100 lb. lots	lb.	.22½–.40
Salts, single, bbls.	lb.	.11½
Salts, double, bbl.	lb.	.10½
Parrafin	lb.	.05–.06
Phosphorus—Duty free, according to quantity		.35–.40
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	.09
Potassium Bichromate, casks	lb.	.11
Carbonate, 80-85%, casks	lb.	.06
Cyanide, 165 lb. cases, 94-96%	lb.	.65
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Official	oz.	—
Rosin, bbls.	lb.	.03½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.45½
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—		
Biborate, see Borax (Powdered), bbls.	lb.	.06
Cyanide, 96 to 98%, 100 lbs.	lb.	.23
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls.	lb.	.03
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass) bbls.	lb.	.02
Sulpho Cyanide	lb.	.45
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.12–.13
Sulphur (Brimstone) bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.32
Tripoli	lb.	.03
Verdigris, see Copper Acetate	lb.	.37
Water Glass, see Sodium Silicate, bbls.	lb.	.02½
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.35
Whiting, Bolted	lb.	.02½–.06
Zinc. Carbonate, bbls.	lb.	.13–.17
Chloride, 600 lb. lots	lb.	.07
Cyanide	lb.	.37
Sulphate, bbls.	lb.	.03¼

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	42.95
14 inch, 20 ply, 64/68, cloth	base,	53.40
12 inch, 20 ply, 84/92, cloth	base,	45.00
14 inch, 20 ply, 84/92, cloth	base,	60.00
12 inch, 20 ply, 88/96, cloth	base,	48.65
14 inch, 20 ply, 88/96, cloth	base,	65.50
Sewed Buffs, per lb., bleached and unbleached	base,	.60to.75

FELT WHEELS

		Price Per Lb. Less Than 100 Lbs.	300 Lbs. and Over
Diameter—10" to 16"	1" to 3"	2.75	2.50
" 6" 8" and over 16"	1" to 3"	2.85	2.60
" 6" to 24"	Over 3"	3.15	2.80
" 6" to 24"	½" to 1"	3.75	3.50
" 4" to 6"	¼" to 3"	4.75	Any quantity
" Under 4"	¼" to 3"	5.35	

Grey Mexican or French Grey—10c. less per lb. than Spanish, above. Odd sizes, 50c. advance.